TERMITE CONTROL IN ONTARIO

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TERMITE CONTROL IN ONTARIO

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Minister

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TERMITE BIOLOGY AND HABITS

INTRODUCTION

The Eastern subterranean termite Reticulitermes flavipes is probably the most widespread and destructive species of termite on the North American continent.

Every state in the U.S., except Alaska, has some degree of activity. In Canada, subterranean termite activity is limited to two provinces, Ontario and British Columbia. British Columbia also has some dampwood termite activity but, from the most recent reports, it is not significant.

In Ontario, we have 28 municipalities reporting termite activity. An on-going survey conducted annually by the Ministry of the Environment has confirmed the location of termites in areas reporting activity in the past, as well as identifying termites in many new locations.

TYPES OF TERMITES

Generally speaking, there are three types of termites in North America.

1. Dampwood termites.
2. Drywood termites.
3. Subterranean termites.

They are placed into these categories depending on where they live and what they eat.

Dampwood termites are usually found in damp, decaying wood but, once established, can attack sound dry wood. The infestation is started from a swarm and activity is restricted to wood only; there is generally no soil contact.

Drywood termites establish themselves in undecayed sound wood with little moisture, they do not maintain soil contact. This termite is occasionally found in imported goods, such as furniture.

Subterranean termites are the most economically destructive type of termites. They are social insects, feeding on cellulose and living in colonies in the soil. These colonies are close to moisture, and can be readily relocated due to temperature or other environmental changes. Subterranean termites travel through soil; in wood itself, or through shelter tubes.

Classification

Order	Isoptera (iso-equal, ptera-winged)
Family	Rhinotermitidae
Genus	Reticulitermes
Species	flavipes
Common Name	Eastern Subterranean Termite

The Termite Society

A termite has two characteristics which together serve to distinguish it from most other insects.

1. It is able to utilize cellulose as food.
2. It is a social insect.

It is able to obtain nutrition from cellulose with the assistance of bacteria and protozoa living in its gut. These organisms break down the cellulose fibres so that they become digestible by the termites.

The termite is a social insect because:

(a) individuals of the same species cooperate in caring for the young;
(b) there is division of labour, with more or less sterile individuals working on behalf of the reproductives, and there is an overlap of at least two generations; offspring assisting parents at some stage of their life.

The transfer of food from worker to dependent members of the colony - reproductives, immatures and soldiers - is referred to as TROPHALLAXIS. To ensure that the gut of the immature members of the colony contain protozoa and bacteria, these members actively consume feces containing these organisms.

THE LIFE STAGES OF THE EASTERN SUBTERRANEAN TERMITE

In a typical subterranean termite colony there are generally several generations present. The colony is made up of several castes. A caste is a group of insects within a social colony which have a different appearance and carry out specific duties or functions.

The Worker: The worker termites are ivory in colour with a distinct outline of the digestive tract visible through the opaque abdomen. The worker is approximately 6 mm (1/4 inch) in length with straight bead-like antennae and a very thick waist. They can be thought of as walking grains of rice. Worker termites have chewing mouth parts and are responsible for foraging for food (cellulose) and for feeding the dependent members of the colony. The hind gut of the worker, which is visible through the abdomen, contains the protozoa which assists in breaking down the cellulose into digestible nutrients. The worker termite causes the structural damage.

The Soldier: Soldier termites are similar in size and colour to the workers, but have an enlarged amber coloured head with large mandibles used for defence. Soldiers make up 2-3% of the colony.

The Larva: The term larvae is given to all recently hatched members of the colony. The larvae are dependent on the worker caste for food. The term "apterous nymph" is also given to the larva caste; apterous meaning "wingless". The larva may stay at this stage all its life or moult to become a worker, a nymph, a soldier or a tertiary reproductive caste, also called the "ergatoid reproductive".

Nymphs: Nymphs develop from the larvae caste through a series of moults. Nymphs possess wingpads and are also called "brachypterous nymphs" (with wingpads). After moulting to the third instar stage, the nymph may moult to become a soldier-nymph which will moult to become a soldier termite. The third instar nymph may also moult into a secondary reproductive nymph i.e. the nymphoid reproductive or primary reproductive alate (fully winged).

The Secondary and Tertiary Reproductive: These reproductive castes may develop from brachypterous nymphs or from apterous nymphs (larvae). The secondary reproductive caste carries on extensive reproduction i.e. egg-laying in Ontario and may be very numerous in a single colony. Secondary reproductives are distinguishable from nymphs by their very large abdomens and distinguishable from primary reproductives by their ivory coloration.

The Primary Reproductive: This caste is rarely found in Ontario as a source of reproductive function in the colony. Large colonies will produce winged forms called "alates" but rarely do they disperse or swarm. In the U.S., swarming is a common once or twice a year occurrence and accounts for the heavy infestation rate in many urban centres.

The primary reproductive caste is made up of a queen and king. After a mating flight called "swarming" the pair find a suitable nest site, mate, and egg-laying begins. The primary reproductive stages are dark brown to black in colour since they will be exposed to outside conditions and require a hard protective exoskeleton. The wings total four in number and are smokey grey in colour and all of equal length, hence Iso-equal, ptera-wing. In order for the primary reproductives to mate, an actual flight must occur. The wings are shed after mating and the queen becomes an immobile egg-laying machine capable of laying up to 200-300 eggs per day. She may live ten or more years laying thousands of eggs in her life-time. The primary queen is easy to identify but very difficult to

find in Ontario. A black head and abdomen with a vast ovary filled abdomen covered with several dark plates characterize the primary queen. The king is nearly identical except for the abdominal size. The detailed life cycle of Reticulitermes flavipes is shown in Diagrams 18 and 19.

HABITS

The termite colony or nest is not a well-defined area, such as a bee hive or an ant nest, but consists of a series of tunnels and galleries which may be centred in the soil and extend into a tree stump or into a piece of buried wood.

Foraging termites travel through the soil in tunnels and above ground food sources in shelter tubes. These shelter tubes are constructed of soil particles cemented together with a secretion from a gland in the frontal area. The most obvious shelter tubes are seen on trees as well as on concrete basement walls. Shelter tubes are further employed as a means of crossing, or by-passing materials, such as concrete or steel, that cannot be penetrated by the termite.

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GUIDELINES FOR INSPECTION FOR TERMITES IN ONTARIO

To carry out a visual inspection for termites successfully, some knowledge of the lifecycle of these insects, and of the way buildings are constructed, is necessary. With a good knowledge of termite behaviour, a flashlight and a probing tool you can provide a professonal service of shelter protection which is, in other words, equity protection for the homeowner.

Termites need high humidity to survive. This moist atmosphere is normally found in the soil where they live, but if, in exploring for food, for example, they need to leave the soil they construct shelter tubes. The shelter tubes are mainly used in the search for new food sources, but also serve as flight tunnels for emerging winged termites. In a visual survey the shelter tubes show up clearly in basements, crawl spaces, along pipe ducts and rafters, and up fences and trees.

Depending on the number of termites in the colony, up to 60 cm of tubing can be built in a day, since the worker termite works 24 hours a day.

First, visually survey the outside of the building. The basic places include:

1. Window sills and frames which should be checked with the probe.

2. Door frames and base of wooden steps which should also be probed.

3. Utility lines and pipes for termite tubing entering into structure.

4. Ivy and bushes which should be pulled back to look for shelter tubing along walls.

5. Fence posts, trees and hydro poles on the property.

6. Wood/soil contact under porches, behind garages, between houses, wood piles, sand boxes, wooden planters, tomato stakes and so on.

7. Note the soil type, i.e., is it sandy loam or clay, soil compaction, soil moisture and grade conditions, as these factors will effect emulsion separation rates.

8. Note the domestic water supply, i.e., cistern or deep wells, etc.

Secondly, the interior of the building is investigated.

The major areas to check in the interior and exterior inspection are shown in Diagrams 10 and 11.

Other areas that should be examined include:

1. Window sills and door frames (See Diagram 12).

2. Wooden supporting posts, wooden floors and base-boards (See Diagram 13).

3. Chimney areas (especially around the ash door).

4. Around heaters.

5. Basement stairs (See Diagram 10).

6. Cracks in basement flooring.

7. All joists.

8. Bathrooms, kitchens and other areas where water pipes occur.

9. Areas in the home that are very moist (sub-colonies may establish near roof leaks).

10. All crawl spaces, fruit cellars and sump areas.

11. Walls and crawl spaces should be checked for tubing. Most tubes built unsuspended are initiated from the top with a maximum length of 20-30 cm.

12. Areas of high moisture and low ventilation should be rigorously inspected.

13. Areas where outside downspouts enter the soil to the weeping tile (inspect foundation wall adjacent to these areas).

14. Furnaces and fireplaces (they may provide heat to adjacent soil) (see Diagram 17).

It is necessary to know the basic structural and housing terminology (See Diagram #1). In order to successfully and safely treat a property you must be thoroughly familiar with the construction of the building. In some cases, the services of a structural or building engineer will be required for advice. The following is a list of the more common terms and their definitions.

Building Construction - Definition of Terms

Attic or Roof Space. The space between the top floor ceiling and roof and between a dwarf partition and sloping roof.

Back Fill. The material used to re-fill an excavation around the outside of a foundation wall or pipe trench.

Baseboard. A moulded board placed against the wall around a room next to the floor to conceal the joint between the floor and wall finish. (See Diagram 3)

Beam. a horizontal structural member usually wood, steel or concrete used to support vertical loads. (See Diagram 13)

Bearing. the part of a joist, rafter, truss or beam which actually rests on its support and the area of the support on which it rests.

Bearing Wall. A wall that supports any vertical load in addition to its own weight.

Block (Hollow). A shape made of clay, terra cotta or other material fashioned with one or more openings in its body for lightness, whose net sectional area does not exceed 75 percent of its gross sectional area. (See Diagram 8).

Brick. A structural unit of burnt clay or shale formed while supple into a rectangular prism, usually solid, the net sectional area of which is not less than 75 percent of the gross sectional area. (See Diagram 8 and 9)

Brick Veneer. A facing of brick tied to a wood-frame or masonry wall, serving as a wall covering only and carrying no structural loads.

Crawl Space. A shallow space between the lowest floor of a house and the ground beneath.

Dampproof Course. A dampproof material placed just above the ground level in a brick or stone wall to prevent ground moisture from seeping up through the structure.

Dampproofing. The process of coating the outside of a foundation wall with a special preparation to resist passage of moisture through the wall. Material used to resist the passage of moisture through concrete floor slabs and from masonry to wood.

Eave. The lower part of a roof which projects beyond the face of the walls.

Eave Soffit. The under surface of the eave.

Eaves Trough. A trough fixed to an eave to collect and carry away the run-off from the roof. Also called a gutter.

Expansion Joint. A joint in a concrete or masonry structure designed to permit expansion without damage to the structure.

Flashing. Sheet metal or other material used in roof and wall construction to shed water.

Footing. The widened section, usually concrete, at the base or bottom of a foundation wall, pier, or column.

Formwork. Temporary sheets or boards (metal or wood) carefully fixed and braced to form required profile into which concrete is poured, e.g., for a concrete foundation wall. Removed when concrete is properly set.

Foundation. The lower portion, usually concrete or masonry and including the footings, which transfers the weight of, and loads on, a building to the ground. (See Diagram 6 and 7)

Grade. The surface slope. The level of the ground surface around the foundation wall. To modify the ground surface by cut and fill.

Header (Framing). A wood member at right angles to a series of joists or rafters at which the joists or rafters terminate. When used at openings in the floor or roof system the header supports the joist or rafters and acts as a beam.

I-Beam. A steel beam with a cross section resembling the letter "I".

Insulation. Material used to resist heat transmission through walls, floors and roofs.

Jamb. The side post or lining of a doorway, window, or other opening.

Joist. One of a series of horizontal wood members, usually 38 mm thickness, used to support a floor, ceiling or roof. (See Diagram 2)

Joist Hanger. A steel shaped like a stirrup, bent so it can be fastened to a beam to provide end support for joists, headers, etc.

Ledger Strip. A strip of lumber fastened along the bottom of the side of a beam on which joists rest.

Lintel. A horizontal structural member (beam) that supports the load over an opening such as a door or window.

Mudsill. Timber placed directly on the ground as a foundation for a structure.

Non-Bearing Partition. A wall which separates space into rooms, but supports no vertical load except its own weight.

On Centre. A terms used to define the point from which measurements are taken - from the centre of one member to the centre of the adjacent member as in the spacing of studs, joists or nails. Also centre-to-centre.

Panel. A large, thick board or sheet of lumber, plywood, or other material. A thin board with all its edges inserted in a groove of a surrounding frame of thick material. A portion of a flat surface recessed or sunk below the surrounding area, distinctly set off by moulding or some other decorative device. Also a section of floor, wall ceiling, or roof, usually prefabricated and of large size, handled as a single unit in the operations of assembly and erection.

Parging. A coat of plaster or cement mortar applied to masonry or concrete walls.

Pier. A column of masonry, usually rectangular in horizontal cross section, used to support other structural members. (See Diagram 13)

Pilaster. A pier forming an integral part of a wall and partially projecting from the wall face.

Plain Concrete. Unreinforced concrete.

Portland Cement. A hydraulic cement consisting of silica, lime and alumina intimately mixed in the proper proportions and then burned in a kiln. The clinkers or vitrified product, when finely ground, form an extremely strong cement.

Pressure-Treatment. Impregnation of wood or plywood with chemicals under pressure to prevent decay and insect (termite) attack.

Radiant Heating. A method of heating, usually consisting of coils or pipes, or electric heating elements placed in the floor, wall, or ceiling.

Rafter. One of the series of structural members of a roof usually of 38 mm thickness designed to support roof loads, but not ceiling finish.

Rail. A traverse piece of wood (or metal) extending from one vertical member to another in the construction of doors, fences, balustrades, staircases, etc. In framing and panelling the horizontal pieces are called rails and the perpendicular are stiles.

Ridge Beam. A horizontal structural member usually 38 mm thick, supporting the upper ends of rafters.

Ridge Board. A horizontal member usually 19 mm thick at the upper end of the rafters, to which these rafters are nailed.

Sheathing Paper. Paper treated with tar or asphalt used under exterior wall cladding as protection against the passage of water or air.

Sill. The horizontal member forming the bottom of an opening such as a door or window.

Sill Plate. A structural member anchored to the top of a foundation wall, upon which the floor joists rest.

Slab. Basement floor of poured concrete (at least 75 mm thick). Slab should not bear directly on wall or column footing but should be isolated from there by a minimum 25 mm sand cushion or other means. (See Diagram 4 and 5)

Soffit. The underside of elements of a building, such as staircases, roof overhangs, beams, etc.

Span. The horizontal distance between supports for beams, joists, rafters, etc.

Splash Block. A small masonry block laid with the top close to the ground surface to receive roof drainage and divert it away from the building.

Stucco. Most commonly refers to an outside plaster made with portland cement as its base.

Stud. One of a series of wood structural members (usually 38 mm thickness) used as supporting elements in walls and partitions. (Plural: Studs or studding).

Subfloor. Boards or sheet material laid on joints under a finish floor.

Termite Shield. A barrier, usually of non-corrodible metal, placed in or on a foundation wall or other mass of masonry or around pipes to prevent passage of termites (see Diagram 14).

Tie. Any unit of material used to resist the spreading of a wall, or the separation of the two solid parts of a hollow wall.

Vapour Barrier. Material used to retard the passage of water vapour or moisture.

Water Table. The level below which the ground is saturated with water.

Weatherstripping. Strips of felt, rubber, metal or other material, fixed along the edges of doors or windows to keep out drafts and reduce heat loss.

Weephole. A small hole, as at the bottom of a retaining wall or masonry veneer, to drain water to the exposed face.

TERMITE SHIELDS

The use of termite shields is illustrated in Diagram 14. These do not generally extend far enough out from the surface to be effective. In addition, where the metal plates are jointed together, ideal sites for termite shelter tubing are created.

DAMAGE CAUSED BY OTHER WOOD-BORING INSECTS AND DECAY

During an inspection for termites, damage to wood caused by other insects may be seen. In some instances, such infestations may have occurred while the lumber was in the field prior to cutting and construction, and will most likely have since died out. The insects responsible for so called field damage include Timber, Ambrosia Bark, Buprestid and Cerambycid beetles (except the Old house and New house borer beetles).

By contrast, damage caused to wood inside a house after construction is often due to Powder Post, Furniture and Bostrichid beetles, and Carpenter ants. Occasionally Old House and New House Borer beetles may also be involved.

Decay of wood is caused by low forms of plant life known as fungi, which feed upon the wood substance (mostly cellulose) of the cell walls. Under favourable conditions decay may spread from spores (seed-like bodies) produced by the fungi. Growth of wood-destroying fungi is dependent on three principal factors; absence or removal of one or more of these will prevent decay. These factors are:

- Adequate moisture content.
- Supply of air to furnish oxygen.
- Favourable temperature.

Moisture is an essential condition for fungal growth and the easiest to control. If dry materials are used in building, and moisture prevented from reaching or accumulating in wood portions of the structure, decay will be eliminated. Adequate ventilation will usually prevent accumultion of moisture in enclosed areas. At moisture contents below the fibre-saturation point, decay is greatly retarded; below 20%, growth of fungi is completely inhibited. "Dry rot" is a misnomer since moisture is required; there are, however, certain fungi which can draw water by capillary action from a moist to a dry location.

Table #1 shows the basic characteristics of wood destroying and wood boring insect damage. Table #2 outlines the various types of wood destroying and boring insects, their characteristics and associated behaviour in addition to control procedures if required.

A knowledge of the structure and properties of wood is also necesary in order to understand the association with the insect factor. The common terminology used in discussing wood characteristics is given below.

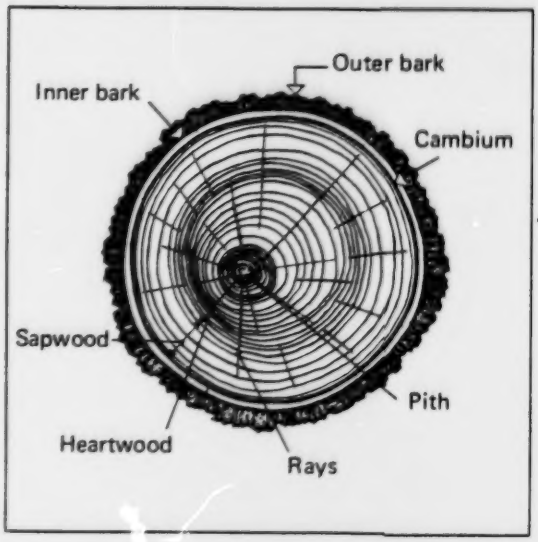
Wood, Lumber and Timber - Definition of Terms

Annual growth ring: The ring seen on a transverse section of a piece of wood composed of contrasting springwood and summerwood and denoting one year's growth.

Broad-leaved trees: Trees which shed their leaves in the autumn. Most broad-leaved, or deciduous, trees are hardwoods and have broad leaves.

Cambium: The one-cell thick layer of tissue between the bark and the wood in a tree. It repeatedly subdivides to form new wood and bark cells.

Cell: General term for the minute units of wood structure, including wood fibres, vessel segments and other elements.



Tree Cross-Section

Cellulose: The carbohydrate that is the principal constituent of wood. It forms the framework of wood cells.

Decay: The decomposition of the wood substance caused by the action of the wood-destroying fungi, resulting in softening, loss of strength and weight, and often in change of texture and colour.

Density: Weight per unit volume. In the case of wood, density is usually expressed as pounds per cubic foot at a specified moisture content.

Equilibrium moisture content: The moisture content at which wood neither gains nor loses moisture when surrounded by air to a given relative humidity and temperature.

Extractives: Substances in wood (not an integral part of the cellular structure) that can be removed by solution in hot or cold water, benzene, or other solvents that do not react chemically with wood components.

Fibre, wood: A comparatively long, narrow, tapering wood cell closed at both ends.

Fibre saturation point: The stage condition of wood in which the cell walls are saturated and the cell cavities are free of water, at approximately 25-30 percent moisture content.

Grain: The direction, size, arrangement, appearance or quality of the fibre in wood or veneer. To have a specific meaning the term must be qualified.

Cross-grain: A pattern in which the fibre and other longitudinal elements deviate from line parallel to the sides of the piece. Applies to either diagonal or spiral grain or a combination of the two.

Diagonal-grain: Grain in which the longitudinal elements form an angle with the axis of the piece as a result of sawing at an angle with the bark of the tree or log; a form of cross grain.

Edge-grain (rift-sawn, vertical grain, quarter-sawn, quarter cut): Terms referring to timber or veneer cut in a plane approximately at right angles to the annual rings, and means a condition in which the rings form an angle of 45 degrees or more with the face of the piece.

Flat-grain (flat-sawn, plain-sawn, slash-grain): Terms referring to timber or veneer cut in a plane approximately tangential to the annual rings, and means a condition in which the rings form an angle of less than 45 degrees with the face of the piece.

Spiral-grain: An arrangement of the fibres in a piece of timber or veneer which results from their growth in a spiral direction around the bole of the tree.

Straight-grain: A condition where the fibres of the wood run parallel or nearly parallel to the edges of the piece.

Green or unseasoned: Freshly sawed lumber, or lumber that has received no intentional drying. The term does not apply to lumber completely wet because of water-logging.

Hardwoods: Generally one of the botanical groups of trees that have broad leaves in contrast to the conifers or softwoods. The term does not necessarily refer to the actual hardness of the wood.

Heartwood: The inner core of a woody stem wholly composed of nonliving cells and usually differentiated from the outer enveloping layer (sapwood) by its darker colour. It is usually more decay resistant than sapwood.

Knot: The portion of a branch or limb that has been surrounded by subsequent growth of wood of the trunk or other portion of the tree.

Lignin: The second most abundant constituent of wood; the thin cementing layer between the wood cells.

Moisture content: Weight of water in wood expressed as a percentage of weight of oven dry wood.

Pitch: Accumulation of resin in wood.

Pith: The small cylinder of primary tissue of a tree stem around which the annual rings form.

Rays: Strips of cells extending radially within a tree and varying in height from a few cells in some species to 4" or more in oak. The rays store food and transport it horizontally in the tree.

Sap: The watery fluid that circulates through a tree carrying the chemical food that enables the tree to grow.

Sapwood: The wood of pale colour near the outside of the log. Under most conditions sapwood is more susceptible to decay than heartwood.

Seasoning: The process of drying timber to a moisture content appropriate for the conditions and purposes for which it is to be used. A moisture content of less than 19% is considered seasoned.

Air-dried: Dried by exposure to air, usually in a yard, without artificial heat.

Kiln-dried: Dried in a kiln with the use of artificial heat.

Shrinkage: The decrease in the dimensions of wood owing to a decrease of moisture content.

Softwoods: Generally, one of the botanical groups of trees that in most cases have needlelike or scalelike leaves, the conifers. The term does not refer to the actual hardness of the wood.

Springwood: The portion of the annual growth ring that is formed during the early part of the season's growth; it is usually less dense, lighter in colour, and weaker mechanically than summerwood.

Stain: A discolouration on or in lumber other than its natural colour.

Summerwood: The portion of the annual growth that is formed after the springwood formation has ceased. It is usually more dense and stronger mechanically than springwood.

Vessels (hardwoods only): Wood cells of comparatively large diameter that have open ends and are set one above the other so as to form continuous tubes. The openings of the vessels on the surface of a piece of wood are usually referred to as pores.

Wood Substance: The solid material of which wood is composed. 50% cellulose, 15 to 30% hemicellulose, 15 to 35% lignin and 5 to 30% ash and extractives.

(From Canadian Wood Construction 6d Wood WP-1 1977/CWC)

GUIDELINES FOR TERMITE CONTROL

Operators Qualifications: The termite exterminator must be licensed by the Province of Ontario in accordance with The Pesticides Act. A class 5 structural licence is required to apply chemical termiticides and an endorsed structural class 4 licence is required to assist a 5. A satisfactory completion certificate must be submitted at the completion of each job (See Appendices III, IV and V).

Biological Control: The use of nematodes as control for subterranean termites still lacks efficacy data. Although available for use in Ontario nematodes are not required to be registered by the (Pest Control Products Act (federal)). Control of termites with nematodes has not yet been proven effective. More research is needed into the best application methods and related environmental conditions.

Chemical Control: The following pesticides are currently registered for termite control in Canada and classified in Ontario. These are:

(1) Chlordane - 1%
(2) Aldrin - 0.5%
(3) Dieldrin - 0.5%
(4) Chlorpyrifos - 1%

The above listed termiticides can be applied as a pre-treatment of new construction or as a treatment to existing structures in areas designated as being termite infested.

Use only as much termiticide emulsion necessary to form a continuous barrier against termite invasions. Variable soil conditions may not allow for the recommended rates to be applied in all areas around the structure. Rates given are for ideal soil conditions, i.e., excellent termiticide retention and absorption. Termiticide can be applied only after proper site preparations, including removal of all wood/soil contact, have been completed. Attention should be paid to applicator safety and proper handling procedures. Applicators must wear protective clothing inclusive of hand, foot and eye covering. A CSA-approved respirator must be used when applying termiticides in an enclosed space (provide adequate ventilation). Consideration of the design of the structure, water table, soil type, soil compaction, grade condition and location and type of domestic water supplied will determine proper application methods. During and after treatment, clean up of any spills is mandatory and drill holes must be properly sealed. Consult the label for first aid, toxicological and disposal information. Additional information can be obtained from the Aldrin 4E Termiticide Manual, the Residue Management Guide for Professional Pest Control Operators Velsicol Chemical Corporation and the Termiticide Cleanup Manual-Velsicol Chemical Corporation.

DIRECTIONS FOR USE
Site Preparation:

Termiticides can control subterranean termites only when applied after proper site preparation.

New Construction: Remove all wood and cellulose debris from the property prior to erecting forms for pouring concrete. After pouring concrete slabs, walls, piers, etc., remove all framework wood from the building site. Do not use back fill containing wood or cellulose. It is important that new construction has a minimum wood-to-soil clearance of 50 cm in order to discourage termite invasion.

Existing Structures: Replace all infested wood damaged beyond repair and dispose of in municipality-approved sites. Correct all conditions leading to abnormally high moisture in and around the structure, e.g. - grading, eavestroughing, etc. Break wood-soil contact by the following measures:

- remove all loose wood and other cellulose debris from property around the structure to be protected.
- ensure that adequate clearance (50 cm is desirable) exists between soil and structural wood, support posts, under porches, or in crawl spaces. Excavate and pour new concrete piers if necessary. Wooden support ports can be replaced with steel jack posts.
- window sills below grade level require alteration employing a window well to retain soil. (See Diagram 16)
- outdoor, wooden stair supports should be severed 10-15 cm above soil level and supported by concrete slabs or blocks.
- where wooden siding exists, lower the grade to expose a minimum of 15 cm of foundation wall.
- repair all cracks or other points of entry for termites in foundation walls or concrete floors (e.g. expansion cracks, crevices, weeping tiles, utility holes, etc.) with a commercial sealant, preferably concrete.
- provide adequate ventilation for soil-surfaced crawl spaces under porches or living areas.(See Appendix I)

Mixing Instructions: Prior to mixing, inspect the mixing tank, pumps, hoses and all fittings to ensure that all equipment is in good working order and that there are no leaks. Mix by agitation and maintain gentle continuous agitation during application period. All termiticide applications are to be made through a vertical rod or sub-slab injector with a pressure from 200 to 350 kilopascals. Reduce the pressure in hard soils. Do not leave the mixing tank unattended during mixing or application periods. Consult label directions for exact formulation mixing.

TERMITICIDE APPLICATION

PRE-TREATMENT OF NEW CONSTRUCTION: Termiticide emulsion should be applied to the soil underneath and around concrete slabs, foundations, crawl spaces, piers, etc. so as to provide a continuous chemical barrier against termite invasion. All product is to be applied by rodding or low pressure fan spray to reduce the possibility of spray drift. Flooding or percolating hose application is not permissible. Soil crawl spaces must be covered with a plastic vapour barrier after treatment and provided with adequate ventilation. (See Appendix I)

Slab on Ground

- Apply 5 litres of emulsion /m^2 into the soil beneath the footing prior to pouring the concrete, but after any forms are erected. If the foundation wall is to be constructed of poured concrete the soil beneath the footing must be treated. If the foundation wall is to be constructed of hollow block or brick either the voids may be treated prior to capping at a rate of 1.5 litres/0.5 m or the area beneath the footing may be treated at a rate of 5 litres/m^2.

- Apply 5 litres of emulsion/m^2 into soil that will be covered by concrete slab, attached porches or platforms prior to pouring the concrete, but after any forms are erected. The emulsion should be applied by rodding at 1 m intervals or by low pressure fan spray.

- Apply 6 litres of emulsion/linear metre/ 25 cm to top of footing to the soil backfilled along the outside and inside of foundation walls.

- Apply 6 litres of emulsion/linear metre to a depth of about 25 cm into the soil to the following critical areas: under interior partition walls, beneath footings of interior bearing walls, under pier footings, around utility services i.e. pipes (cap open pipes prior to treating surrounding soil) or other features that will penetrate the slab.

Basement and Crawl Space Construction

- Apply 5 litres of emulsion/m^2 beneath the footing prior to pouring the concrete.
- Apply 5 litres of emulsion/m^2 into soil under proposed basement or crawl space slab and attached porches and platforms prior to pouring concrete, but after forms are erected. The emulsion should be applied by rodding at 1 m intervals or by low pressure fan spray.
- Apply 6 litres of emulsion/linear metre to a depth of about 25 cm into the soil to the following critical areas prior to construction: under proposed interior partition walls, beneath footings of interior bearing walls, under pier footings, around utility services i.e. pipes (cap open pipes prior to treating surrounding soil) or other features that will penetrate the slab.
- If soil beneath footing has been treated the voids of hollow block foundation walls may be treated optionally at a rate of 1.5 litres/0.5 linear metres. Foundations walls must be capped after treatment.
- During backfilling, apply 6 litres/linear metre/25 cm of depth to top of footing to the soil at a distance of approximately 30 cm from the foundation wall. Treat by rodding at 20 - 30 cm intervals or by low pressure fan spray as the soil is backfilled.
- Apply 5 litres/m^2 of emulsion into soil where soil exposed crawl spaces will exist by rodding at 1 m intervals. Cover the treated soil with a vapour barrier and provide adequate ventilation and a clearance (50 cm minimum, if practical). Low pressure fan spray can be used at the above rate if concrete covering will be laid down.

See Appendix VI for an example of pre-construction treatment rates of application.

Following the termite pretreatment, there must be no further disturbance of the soil in treated areas. If, however, this becomes unavoidable, the disturbed area must be retreated.

With the increased promotion of pre-treatment to control termites, companies must be able to understand building blueprint plans if proper termiticide application is to take place. See page 54 (Appendix II) pertaining to blueprint reading with reference to termite pre-treatment. Some of the symbols used to represent various construction materials are outlined in this appendix. For example, the symbol used to describe concrete block would assist the pest control company quoting on a job in determining the quantity of formulation that would be used. Since blocks contain voids where cast does not, extra formulation costs would be involved in this case. Many reference books are also available on the subject of blueprint reading at most libraries and/or bookstores.

TREATMENT OF EXISTING STRUCTURES: Termiticide applications can be made to existing structures to discourage further or future termite damage in areas designated as being termite infested. Follow directions for site preparation above. Termiticides should be applied to soil along the exterior perimeter of the foundation from grade to the top of the footings. The interior of foundation wall voids and support pier voids may be treated if an active infestation exists, but the applicator must assure the wall will hold the chemical treatment. Treat wall voids from outside the basement foundation wherever possible. The soil beneath the interior perimeter of the basement slab next to the foundation, along partition walls and around support piers and stairway stringers should also be treated.

Remember: Dispersal of the termiticide is the key to satisfactory control.

Treatment of exterior foundation perimeter:

- Apply 5 litres of emulsion/linear metre/25 cm of penetration depth from grade to top of the footings by rodding or injecting at 25-30 cm intervals.

Termiticide must be applied so as to create an even barrier from grade down to the top of footings.

Use caution when rigid insulation exists on outside foundation walls. Solvents will dissolve polystyrene (See Diagram 15).

- Concrete, asphalt, or block sidewalks, driveways, patios, etc. adjacent to foundation must be drilled prior to rodding in chemical. Note: lift patio slabs rather than drill to avoid cracking slabs.

Treatment along interior walls of foundations:

- Concrete floor - drill holes at 30 to 40 cm intervals, 15-30 cm from the foundation and apply at a pressure from 200 - 350 kPa., 7.5 litres/linear metre, with a sub-slab injector. Plug and seal drill holes immediately with good quality mortar to reduce possible air borne residue. Use caution when treating floors containing radiant heating (See Diagram 15). Raised wood floors affixed to wood stringers embedded in the concrete slab must both be removed prior to soil treatment. Where stringers sit on top of the concrete slab, perimeter areas should be exposed to ensure proper visual monitoring of the chemical application. Another option available is to drill, treat and properly seal one hole at a time to avoid spills that otherwise would be inaccessible to clean up.

Soil Floor

- Excavate and level soil in order to provide sufficient clearance to allow rodding of chemical. Apply 7.5 litres/linear metre of emulsion by rodding at 30 to 40 cm intervals, 15 - 30 cm from the foundation wall. Vents must be installed to provide sufficient ventilation for crawl spaces. Treated soil must be covered by a vapour barrier (concrete or polyethylene) under living space areas. (See Appendix I)

Treatment of Wall Voids of Foundation

- Drill holes at 20 to 50 cm intervals just above grade level on the exterior surface of hollow foundation walls if possible (block construction, rubble walls, etc.). Approximate hole spacing for rubble walls is 45 cm apart, 40 cm for block walls and 20 cm for brick walls. Inject termiticide emulsion at 1.5 litres/0.5 linear metre via a sub-slab injector.

Treatment Along Interior Partition Walls

- A basement partition bearing wall extending into or through a concrete floor should be treated through a series of holes drilled at 30-40 cm intervals into the slab along both sides of the wall. Apply 7.5 litres emulsion/linear metre into the soil with a sub-slab injector.

- A basement partition non-bearing wall set on a slab floor should be treated as above, but only along one side of the wall.

Support Posts and Piers

- Apply 6 litres of emulsion/m^2 into the soil beneath the base of support posts via a sub-slab injector for a concrete floor and via rodding for soil floors.

- If the post or pier contains a void, inject emulsion into the void via a sub-slab injector at a rate of 1.5 litres emulsion/0.5 metres.

Following the termiticide treatment there must be no further disturbance of the soil in treated areas. If such is the case, the soil must be retreated.

See Appendix VII for an example of application rates for existing structures.

For a more detailed description of treatment methods please refer to the APPROVED REFERENCE PROCEDURE MANUAL FOR SUBTERRANEAN TERMITE CONTROL (Available through the National Pest Control Association).

TABLE 1 WOOD DESTROYING ORGANISMS

SUMMARY OF DAMAGE CHARACTERISTICS

Insect Group or Species	Flight Hole Diameter	Flight Hole Shape	TIMBER ATTACKED: Unseasoned	Seasoned	Softwood	Hardwood	Sapwood	Heartwood	Frass Characteristics
Lyctids	.8 mm - 3 mm	Round		+		+	+		Flour-like, packed in tunnels, large quantities at flight holes and cracks.
Anobiids	1.6 mm - 3 mm	Round		+	+	-	+	-	Fine to coarse, pellet-shaped, usually a gritty quality. Loose in tunnels, little at exit holes.
Bostrichids	.8 mm -9.5 mm	Round	-	+	-	+	+		Fine to coarse, tightly packed, tends to stick together.
Buprestids	3 mm - 13 mm	Oval	+	-	+	+	+	+	None at flight holes, coarse powder packed in tunnels.
Cerambycids Old House Borer	6 mm	Oval		+	+		+		Tunnels with dust and pellets.
Other Cerambycids	3 mm - 13 mm	Round	+		+	+	+	-	Coarse and fibrous in tunnels.
Wharf Borer	6 mm	Round		+	+		+	+	Shredded and moist.
Scolytids	Less than 1. 6 mm	Round	+		+	+	+	+	Little or none at exit holes. Very little or none in tunnels.
Fungus Moth	1. 6 mm	Round		+	+	+	+	+	Pellets hanging in webbing at exit holes. Pupal skins.

From NPCA Technical Release No. 19-61

Yes +
Occasionally -

TABLE 2
Wood Destroying and Wood Boring Insects

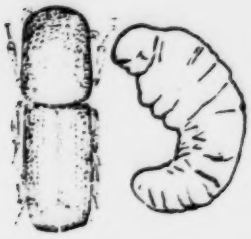
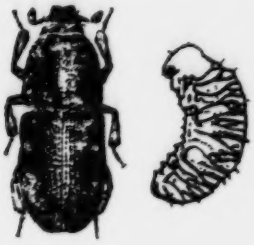
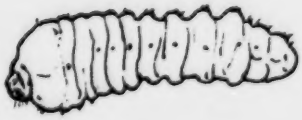
Insect	Description	Wood Attacked	Control
Ambrosia Beetle (SCOLYTIDAE) 	Adult - 3-9 mm long - Cylindrical in shape. - Brown or black in colour. - Antennae short and clubbed. Larvae - C-shaped. - White in colour - No legs present	- Heartwood and sapwood attacked by tunnel making adults. - Fungus spores carried by adult grow on gallery walls for use as nutrient source for adult and larva. - Will not reinfest seasoned wood.	- Proper kilning and curing of wood.
Engraver and Bark Beetles (SCOLYTIDAE) 	Adult - 3-9 mm long - Cylindrical in shape. - Brown or black in colour. - Antennae short and clubbed. Larva - 2-10 mm long. - C-shaped. - White in colour. - No legs present.	- True bark beetles mine between bark/ wood engraving both, twigs and roots may also be mined. - Wood boring bark beetles mine into the wood where adult and larva feed on cellulose. - Will not reinfest seasoned wood.	- Proper kilning and curing of wood.
Long Horned Beetles (CERAMBYCIDAE) 	Adult - 5-80 mm long. - Long antennae. - Very colourful in most species. Larva - Called round-headed borers. - 5-80 mm long. - Usually legless fleshy and elongated in shape. - Thoracic region larger in diameter than abdominal segments but not abruptly. - Abdomen is noticeably constricted beween segements.	- Larva girdle twigs and stems or bore into wood of various conditions and type (species dependent). - Exit hole of adult is oval and broad in shape. - Frass of larva is compact but contains pellet sized granules. - Do not reinfest structural wood (except old and new house borer).	- Removal of bark after cutting of wood. - Retain vigor of ornamental trees. - Use of systemic insecticides

TABLE 2 continued

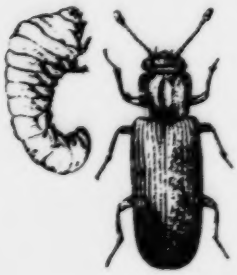
Insect	Description	Wood Attacked	Control
Metallic Wood Borers (BUPRESTIDAE) 	Adult - Flat and oval shape. - 3-40 mm in length. - Some are metallic in colour. - Serrated antennae. Larva - Called flat-headed borers. - 3-50 mm in length. - Distinctly enlarged thorax and a narrow elongated abdomen (each abdominal segment is flattened and noticeably constricted between segments).	- Larvae attack unseasoned hardwoods and softwoods with bark still present. - Exit holes of adult are oval and narrow. - Larvae active for many years in some species. - Do not reinfest seasoned wood.	- Retain vigor of ornamental trees especially birch. - Remove bark of cut wood.
True Powder Post Beetles (LYCTIDAE) 	Adult - 1-7 mm in length. - Reddish brown in colour. - 2 clubs on antennae. - 1st abdominal segment longer than remaining segment. Larva - 1-5 mm in length. - C-shaped. - 8 spiracles on abdomen (last pair 6 times larger). - 3 segmented unclawed legs.	- Dry sapwood of hardwoods are attacked by larva. - Adults will not oviposit on painted or varnished surfaces. - Larva will bore into bamboo and other wicker articles. - Exit holes of adult are round resembling buckshot. - Will reinfest.	- Caution should be taken in bringing wicker articles into households from tropics. - Residual insecticide, fumigation, or sealing of wood surface.

TABLE 2 continued

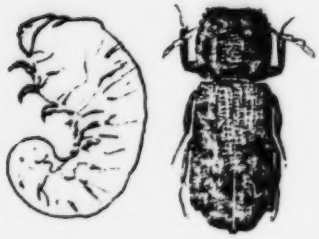
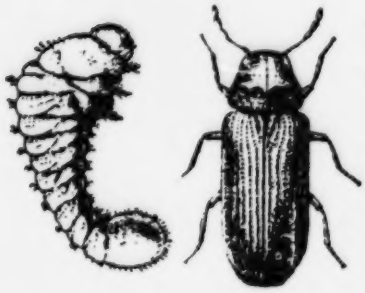
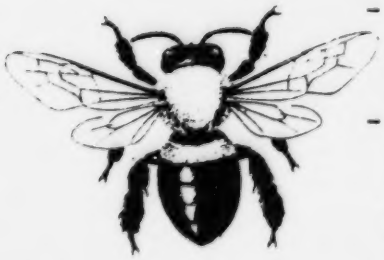
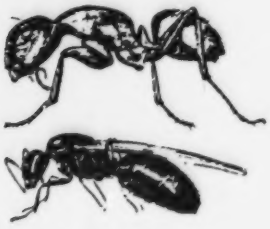
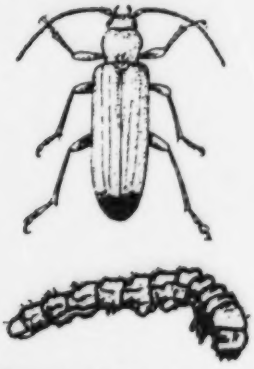
Insect	Description	Wood Attacked	Control
False Powder Post Beetle (BOSTRICHIDAE) 	Adult - 2-20 mm in length. - Head hidden by thorax. - Clubbed antennae with 3-4 segments in clubs (usually sawtoothed). Larva - 3-50 mm in length. - C-shaped.	- Larva bores into soft and hard sapwood. - Exit holes of adult resemble buckshot. - Adult female bores holes into wood to deposit eggs. - Will reinfest.	- Residual insecticide or fumigation.
Furniture Beetle (ANOBIIDAE) 	Adult - 1-9 mm in length. - Cylindrical in shape. - Head is not visible from above. Larva - 3-10 mm in length. - C-shape. - 5 segmented clawed legs.	- Larva bores into well seasoned wood with no bark present. - Will reinfest.	- Fumigation - Residual insecticides
Carpenter Bee (APIDAE) 	Adult - 6-7 mm in length (small Carpenter bee) - Metallic in colour. - Very slender. 18-20 mm in length (large Carpenter bee) - Robust, resemble bumble bee except dorsal surface of abdomen is naked. - Female can sting if handled.	- Female tunnels into wood 15-20 cm to make a brood gallery. - Small species do not bore into structural timber. - Female will reuse old holes.	- Residual insecticide applied to hole.

TABLE 2 continued

Insect	Description	Wood Attacked	Control
Carpenter Ants (FORMICIDAE) 	Colony consists of: (a) large workers 1-1.2 cm (b) small workers 0.8-1 cm (c) reproductives 1-1.5 cm - Usually black or black with red thorax. - One node between thorax and abdomen.	- Moist wood of any sort especially decaying wood. - May make nest in other material. - Wood is not consumed but ejected from galleries.	- Location of nest is important. - Residual insecticide treatment.
Wharf Borer (OEDEMERIDAE) 	Adult - 10 mm in length. - Elytra dull yellow with black tip. - Resemble Cerambycidae. Larva - Up to 30 mm in length. - 3 pairs of long legs on thorax and prolegs on 3rd and 4th abdominal segments.	- Soggy, moist wood and timber.	- Remove moisture source and replace with treated or preserved wood. - Residual insecticide treatment.
Horntails (SIRICIDAE)	Adults - 2-5 cm or greater in length. - Thorax and abdomen uniform in width. - Metallic purple-blue with yellow or red markings. - Dorsal horn like projection (cornus) on female. Larva - Cylindrical, S-shaped. - Anal spine present. - 3 pairs of thoracic legs.	- Larva bores through sapwood to heartwood of low vigor trees. - Exit hole of adult round in shape.	- Do not reinfest. - Residual insecticide will not prevent adults emerging (may take 3-4 years to emerge). - Fill holes with wood filler.

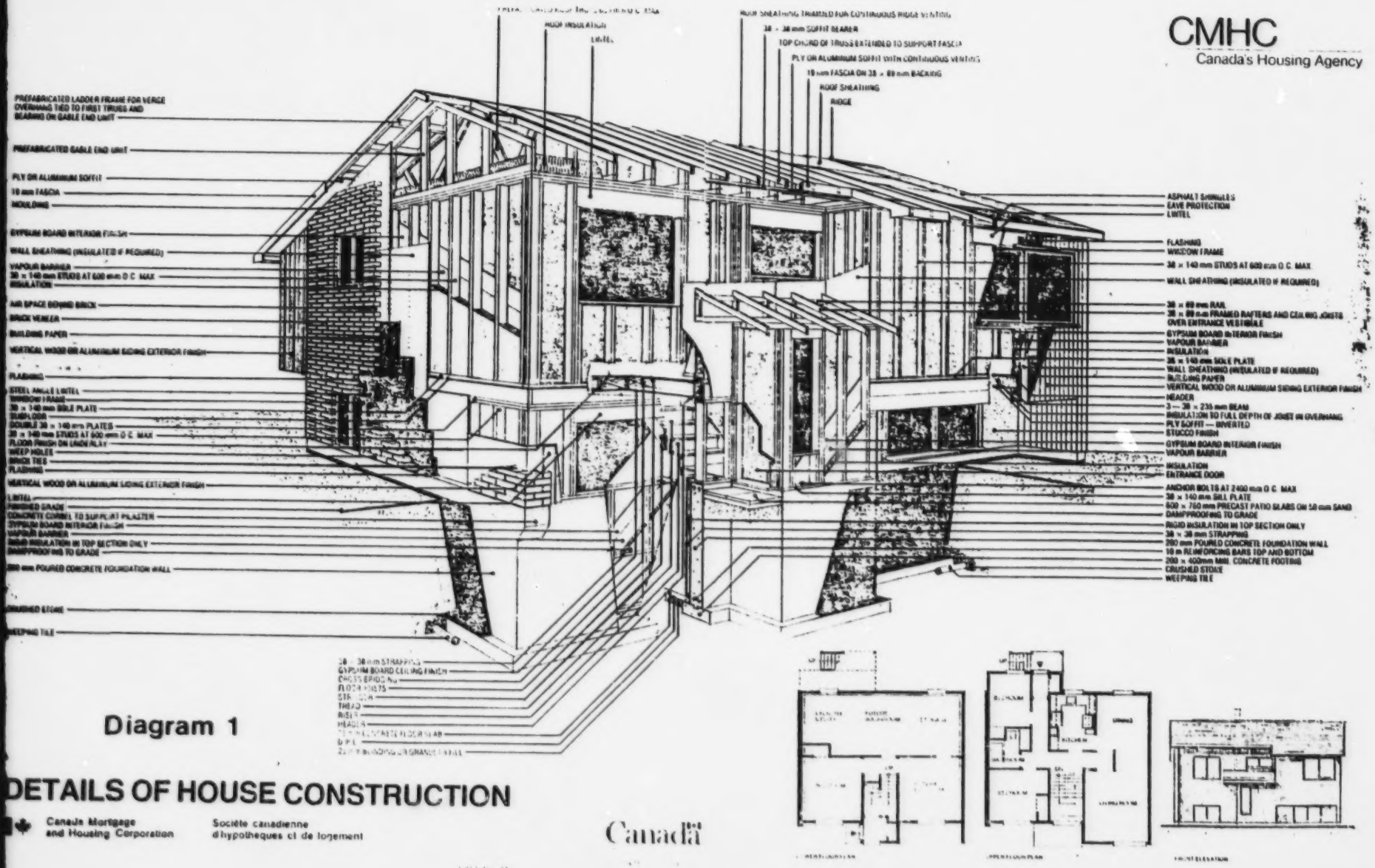

PREFABRICATED LADDER FRAME FOR VERGE OVERHANG TIED TO FIRST TRUSS AND BEARING ON GABLE END UNIT
PREFABRICATED GABLE END UNIT
PLY OR ALUMINUM SOFFIT
10 mm FASCIA
MOULDING
GYPSUM BOARD INTERIOR FINISH
WALL SHEATHING (INSULATED IF REQUIRED)
VAPOUR BARRIER
38 x 140 mm STUDS AT 600 mm O.C. MAX
INSULATION
AIR SPACE BEHIND BRICK
BRICK VENEER
BUILDING PAPER
VERTICAL WOOD OR ALUMINUM SIDING EXTERIOR FINISH
FLASHING
STEEL ANGLE LINTEL
WINDOW FRAME
38 x 140 mm SOLE PLATE
SUBFLOOR
DOUBLE 38 x 140 mm PLATES
38 x 140 mm STUDS AT 600 mm O.C. MAX
FLOOR FINISH ON LAUN PLAY
WEEP HOLES
BRICK TIES
FLASHING
VERTICAL WOOD OR ALUMINUM SIDING EXTERIOR FINISH
LINTEL
FINISHED GRADE
CONCRETE CORBEL TO SUPPORT PLASTER
GYPSUM BOARD INTERIOR FINISH
VAPOUR BARRIER
RIGID INSULATION IN TOP SECTION ONLY
DAMPPROOFING TO GRADE
200 mm POURED CONCRETE FOUNDATION WALL
CRUSHED STONE
WEEPING TILE
ROOF INSULATION
LINTEL
ROOF SHEATHING TRIMMED FOR CONTINUOUS RIDGE VENTING
38 x 38 mm SOFFIT BEARER
TOP CHORD OF TRUSS EXTENDED TO SUPPORT FASCIA
PLY OR ALUMINUM SOFFIT WITH CONTINUOUS VENTING
19 mm FASCIA ON 38 x 89 mm BACKING
ROOF SHEATHING
RIDGE
ASPHALT SHINGLES
EAVE PROTECTION
LINTEL
FLASHING
WINDOW FRAME
38 x 140 mm STUDS AT 600 mm O.C. MAX
WALL SHEATHING (INSULATED IF REQUIRED)
38 x 89 mm RAIL
38 x 89 mm FRAMED RAFTERS AND CEILING JOISTS OVER ENTRANCE VESTIBULE
GYPSUM BOARD INTERIOR FINISH
VAPOUR BARRIER
INSULATION
38 x 140 mm SOLE PLATE
WALL SHEATHING (INSULATED IF REQUIRED)
BUILDING PAPER
VERTICAL WOOD OR ALUMINUM SIDING EXTERIOR FINISH
HEADER
3 — 38 x 235 mm BEAM
INSULATION TO FULL DEPTH OF JOIST IN OVERHANG
PLY SOFFIT — INVERTED
STUCCO FINISH
GYPSUM BOARD INTERIOR FINISH
VAPOUR BARRIER
INSULATION
ENTRANCE DOOR
ANCHOR BOLTS AT 2400 mm O.C. MAX
38 x 140 mm SILL PLATE
600 x 760 mm PRECAST PATIO SLABS ON 50 mm SAND
DAMPPROOFING TO GRADE
RIGID INSULATION IN TOP SECTION ONLY
38 x 38 mm STRAPPING
200 mm POURED CONCRETE FOUNDATION WALL
10 m REINFORCING BARS TOP AND BOTTOM
200 x 400mm MIN. CONCRETE FOOTING
CRUSHED STONE
WEEPING TILE
38 x 38 mm STRAPPING
GYPSUM BOARD CEILING FINISH
CHOICE OF FINISH
FLOOR JOISTS
STRINGER
TREAD
RISER
HEADER
CONCRETE FLOOR SLAB
DPC
FOUNDATION WALL OR GRANULAR FILL

Diagram 1

DETAILS OF HOUSE CONSTRUCTION

CMHC
Canada's Housing Agency

Canada Mortgage and Housing Corporation

Société canadienne d'hypothèques et de logement

Canada

33

Diagram 2
WOOD JOIST CONSTRUCTION

Modern Braced Frame. Courtesy of Delmar Publishers, a division of Litton Educational Industries, Inc.

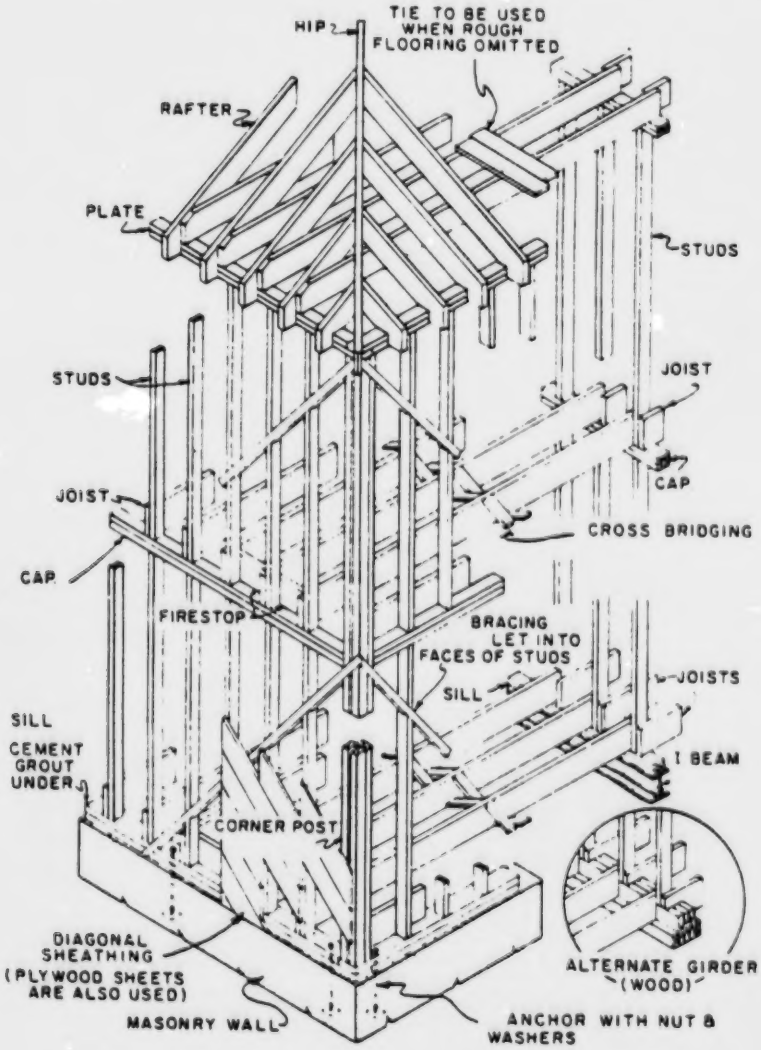
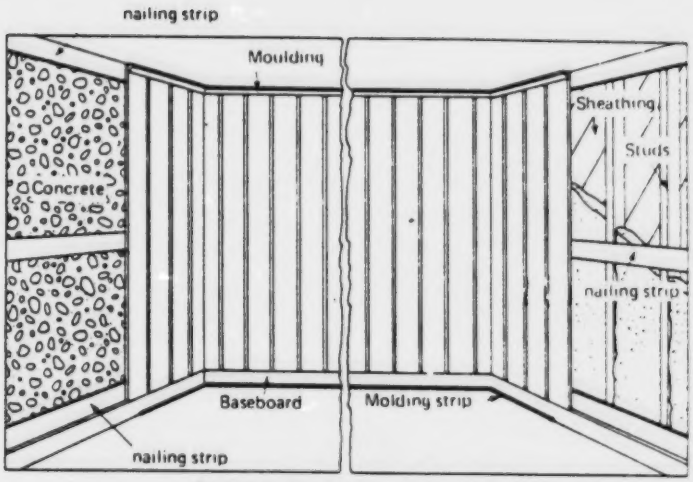


Diagram 3

INTERIOR WALL MATERIALS



Basement Wood frame Construction

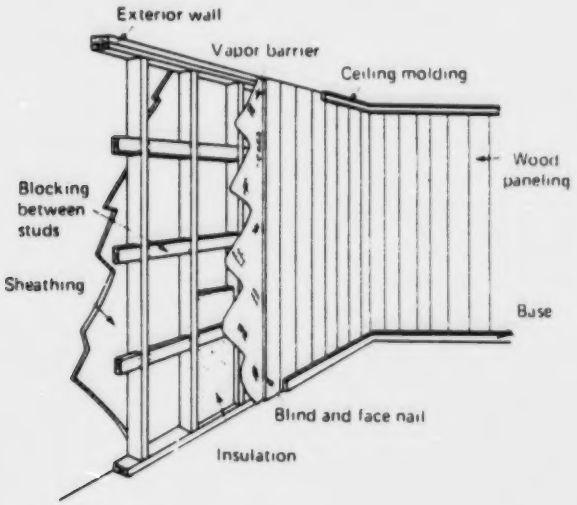
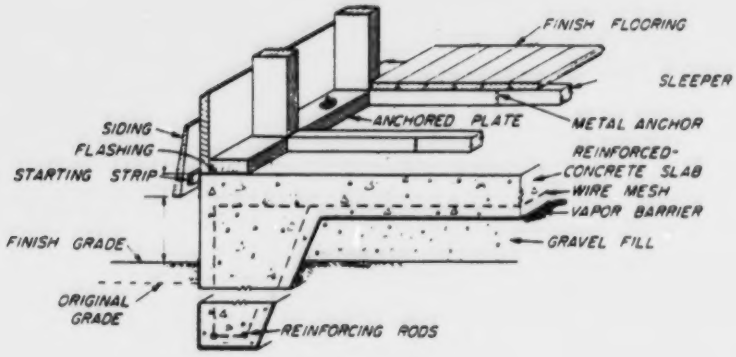
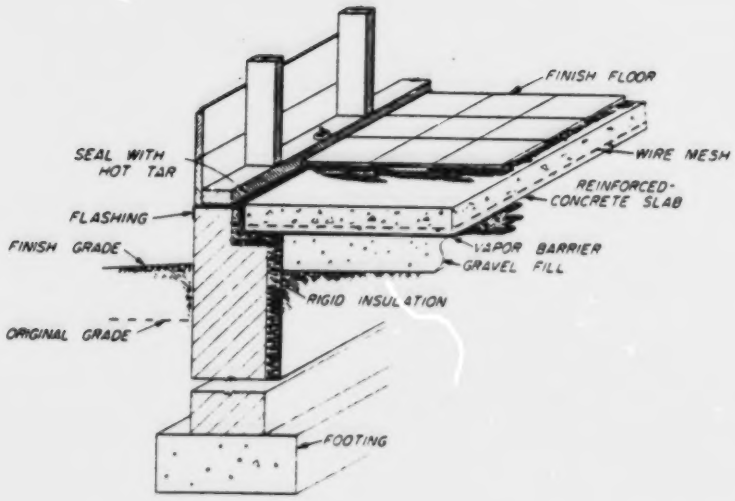


Diagram 4

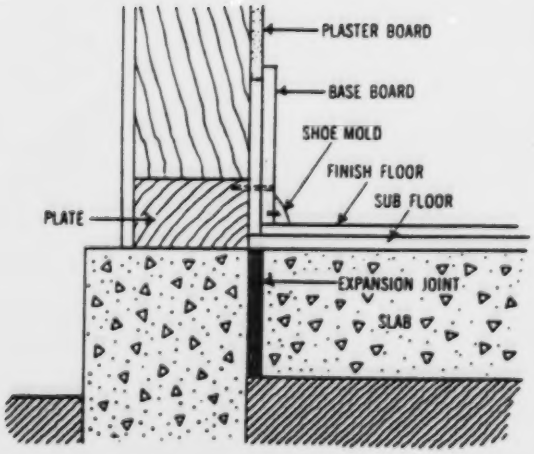
SLAB FLOOR CONSTRUCTION



MONOLITHIC SLAB



SUPPORTED SLAB

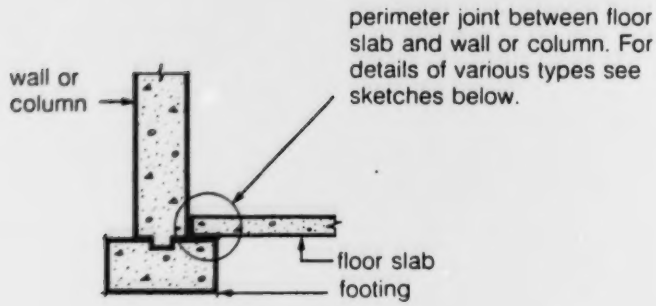


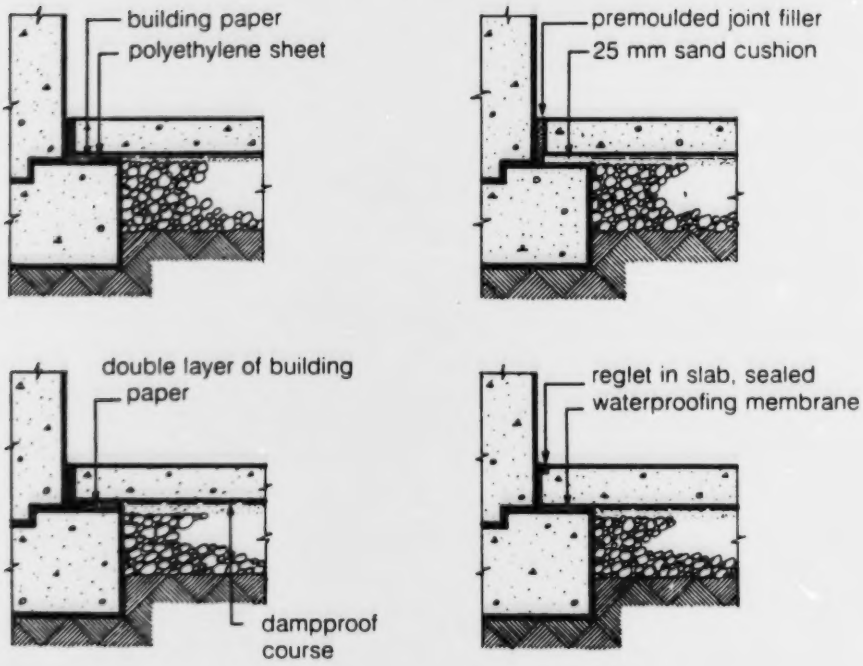
FLOATING SLAB

Diagram 5

Supported Slab

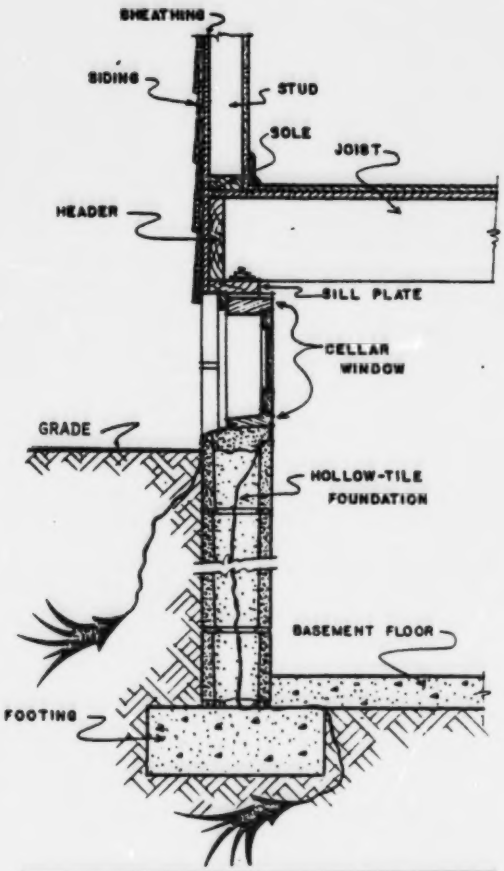
Perimeter joint for floor slab.


perimeter joint between floor slab and wall or column. For details of various types see sketches below.
wall or column
floor slab
footing

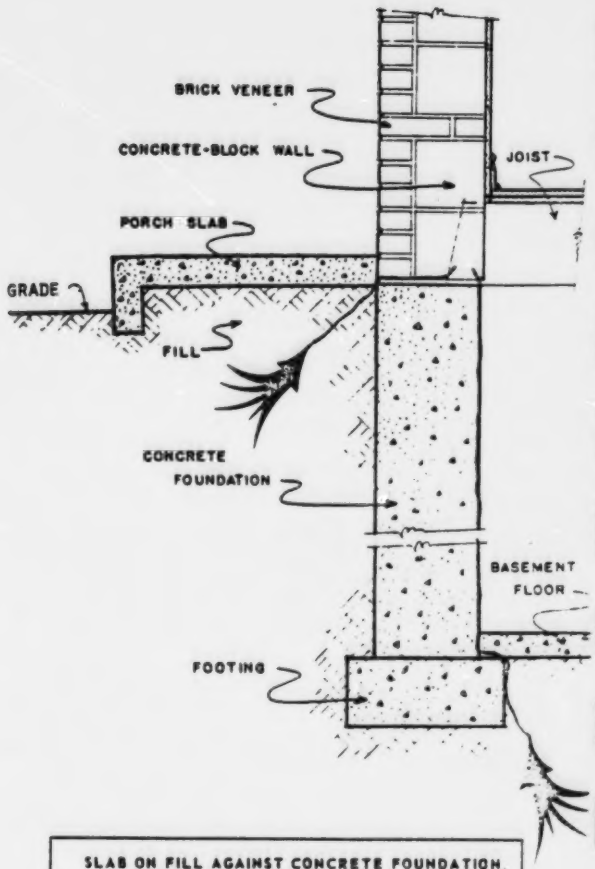


Note: Different combinations of slab/footing and slab/wall isolation joints may be used together, as desired.

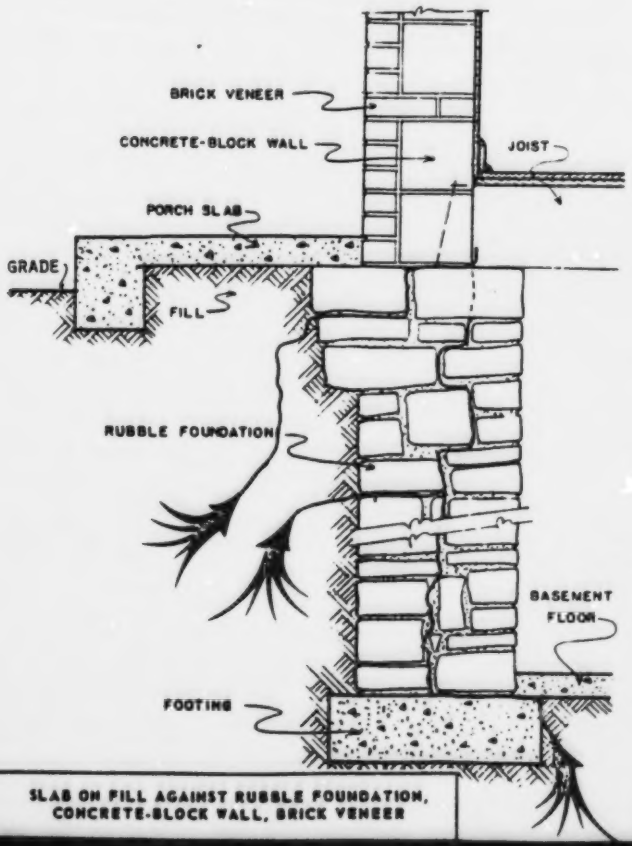
FOUNDATIONS



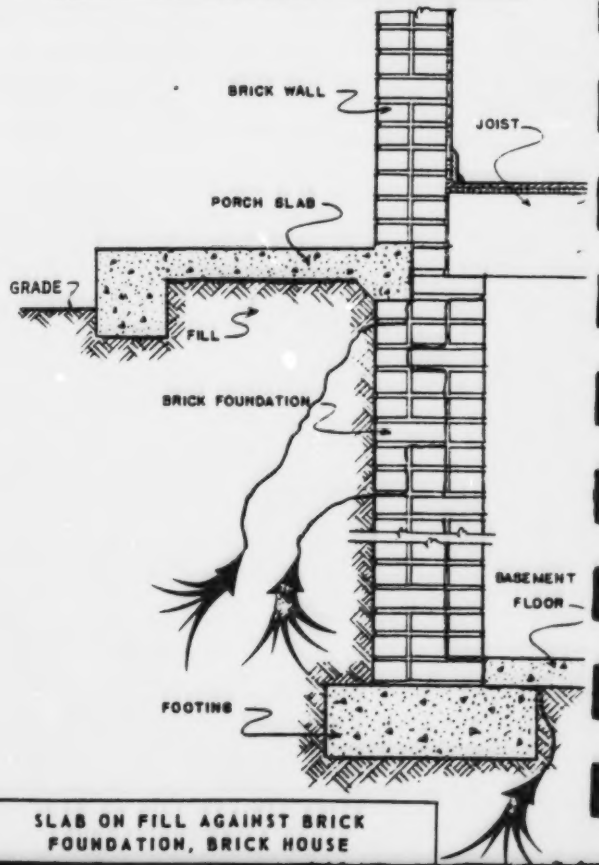
CONCRETE-BLOCK FOUNDATION WITH CELLAR WINDOW



SLAB ON FILL AGAINST CONCRETE FOUNDATION, CONCRETE-BLOCK WALL, BRICK VENEER



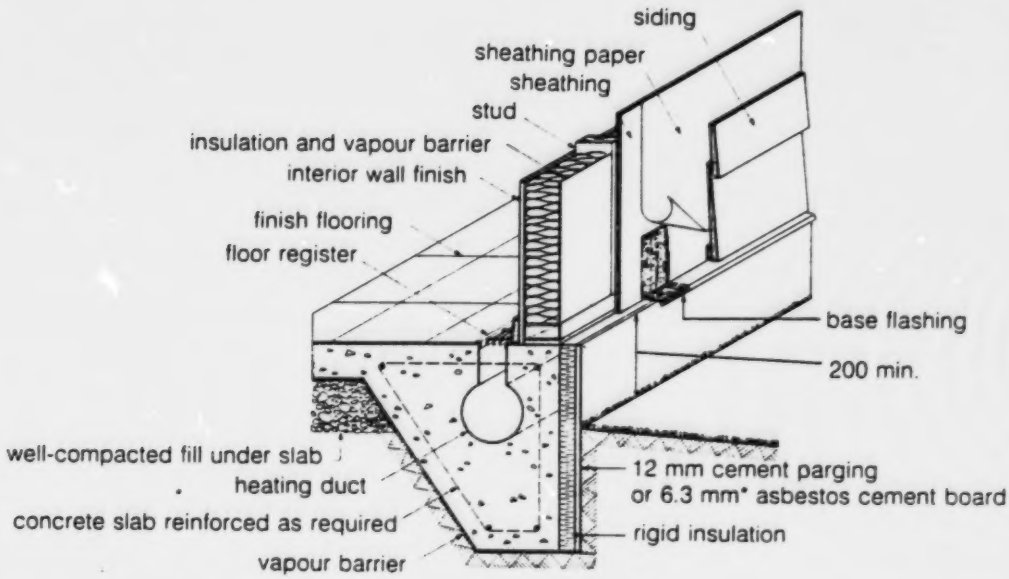
SLAB ON FILL AGAINST RUBBLE FOUNDATION, CONCRETE-BLOCK WALL, BRICK VENEER



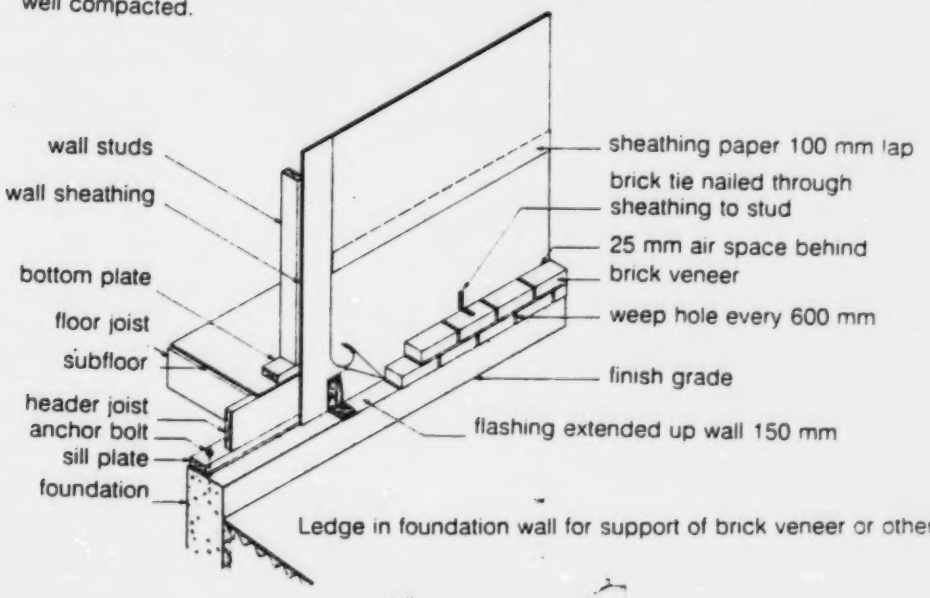
SLAB ON FILL AGAINST BRICK FOUNDATION, BRICK HOUSE

Diagram 7

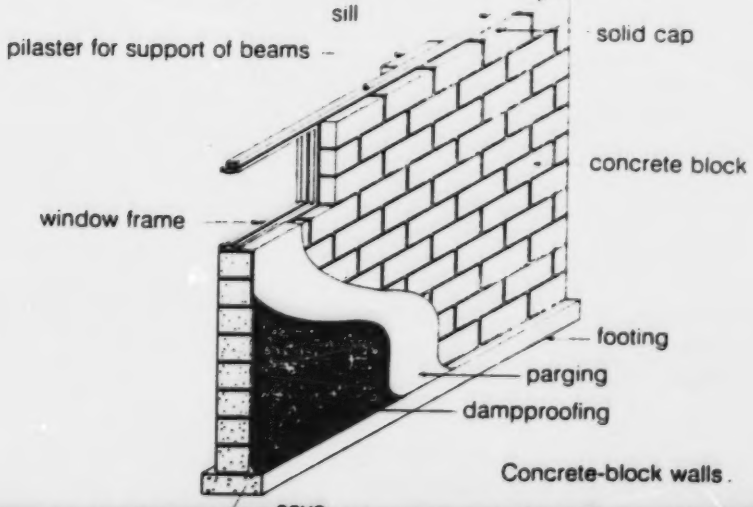
FOUNDATION WALLS



Combined slab and foundation supported on 125 mm of coarse granular fill, well compacted.



Ledge in foundation wall for support of brick veneer or other masonry fir



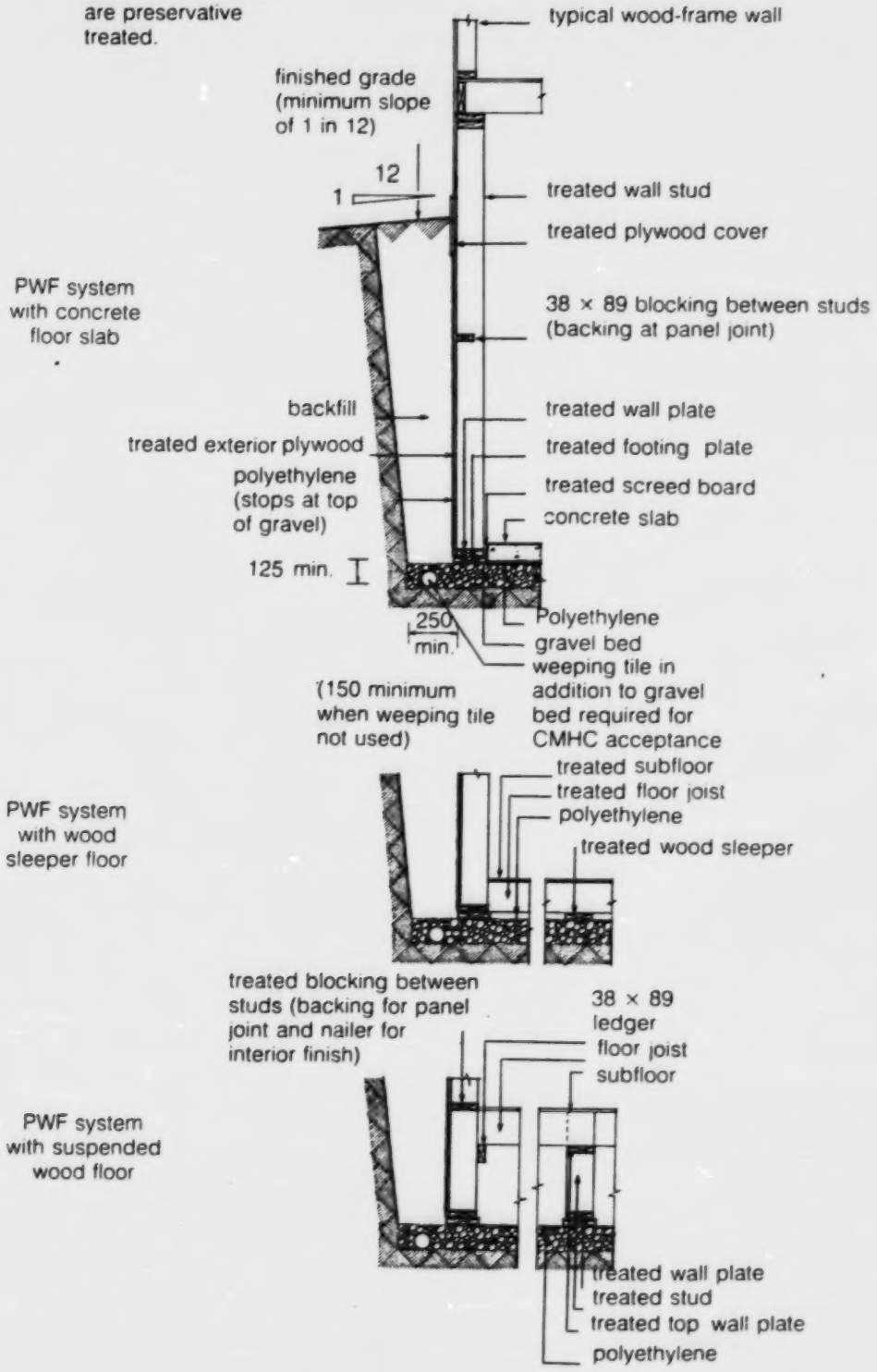
Concrete-block walls.

cove

Diagram 7 continued

FOUNDATION WALLS

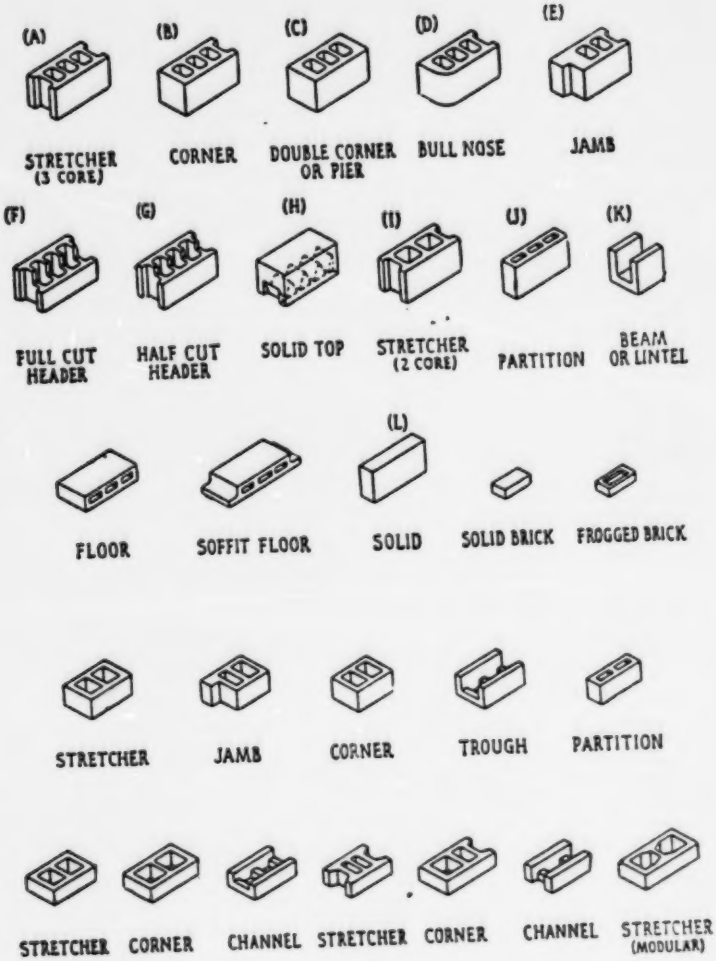
Note: Shaded areas indicate those members that are preservative treated.



Preservative-treated wood foundations

Diagram 8

Concrete Block



Brick Positions

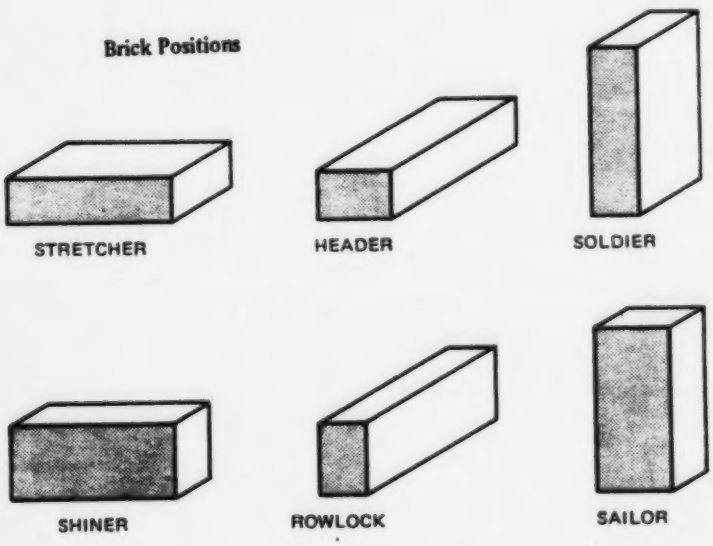
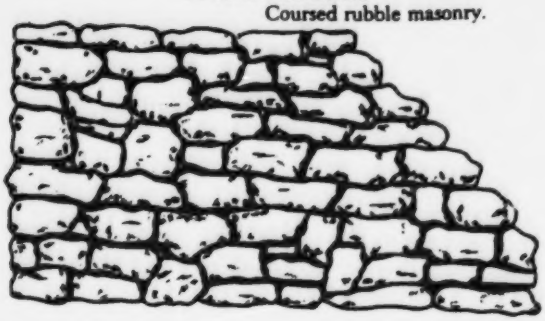
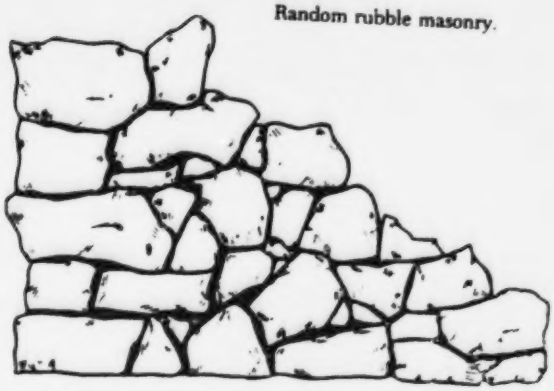


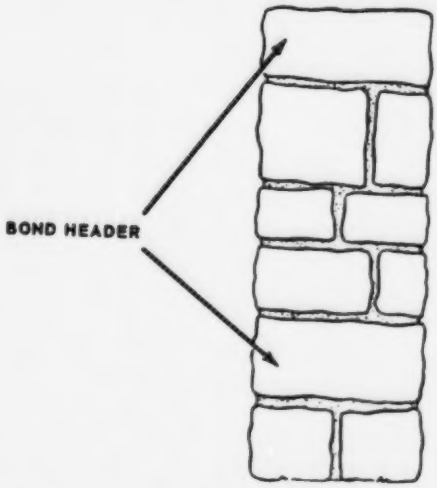
Diagram 9

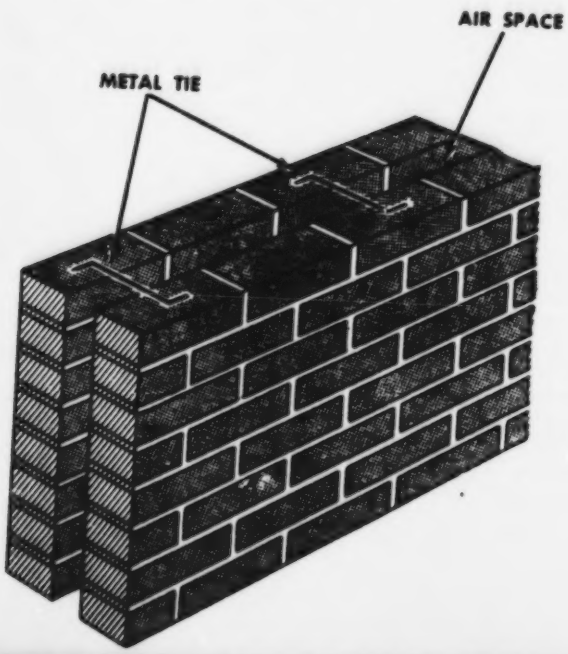
STONE MASONRY
Coursed rubble masonry.



STONE MASONRY
Random rubble masonry.







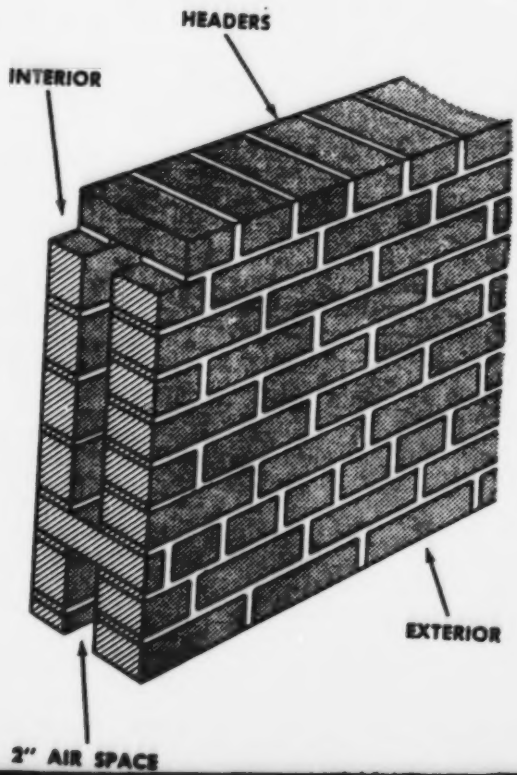
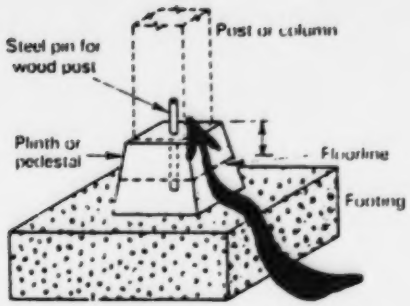
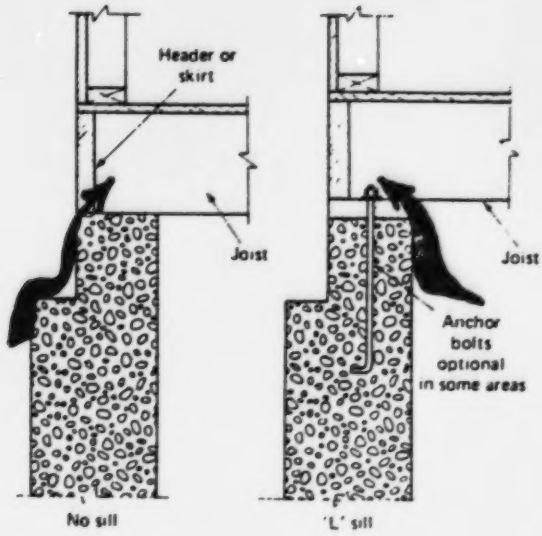
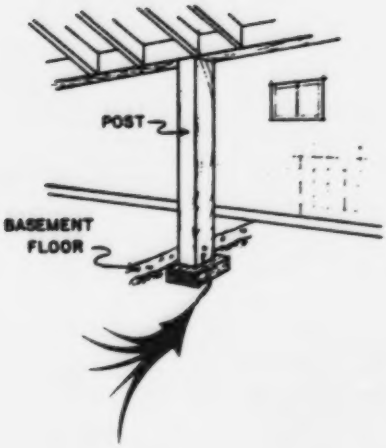


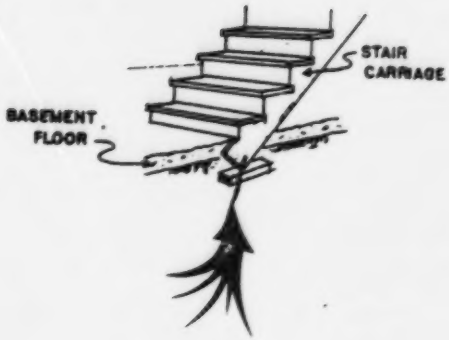
Diagram 10

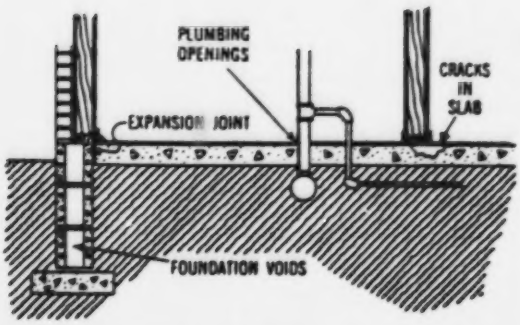
TYPICAL SITES OF INFESTATION



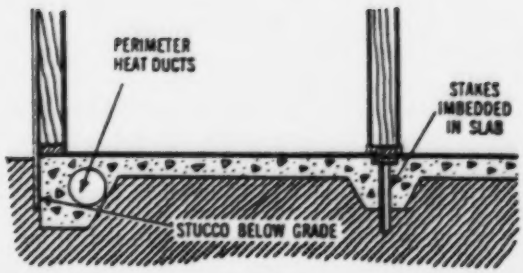








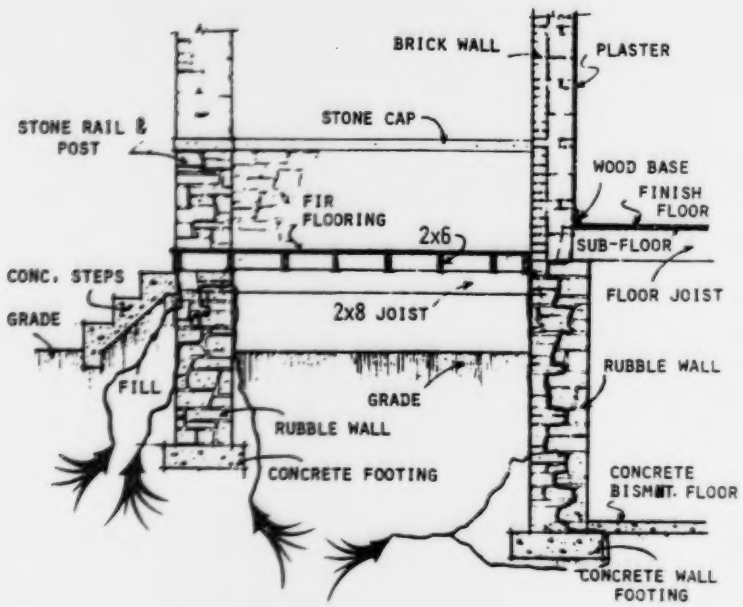
DANGER POINTS in typical slab-on-grade construction where termites can get through to wood above slab.



STRUCTURAL FAULTS such as stucco below grade, cracks in concrete around perimeter ducts, and grade stakes through the slab provide easy entry for termites.

Diagram 11

TYPICAL SITES OF INFESTATION



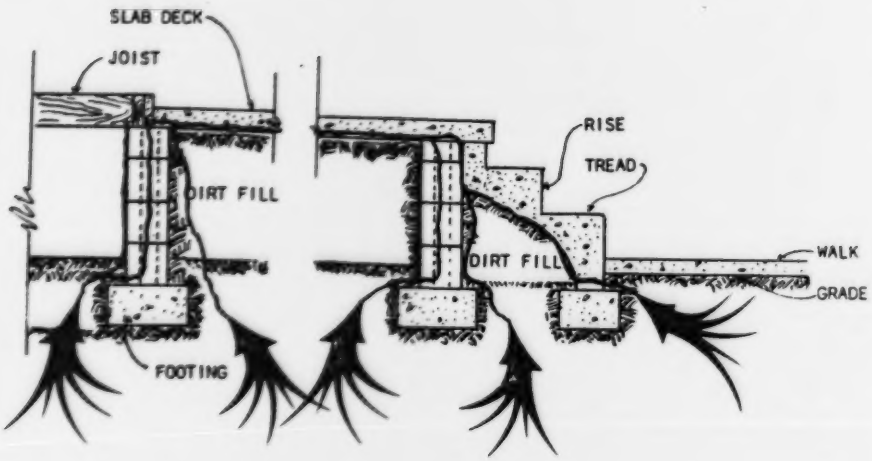
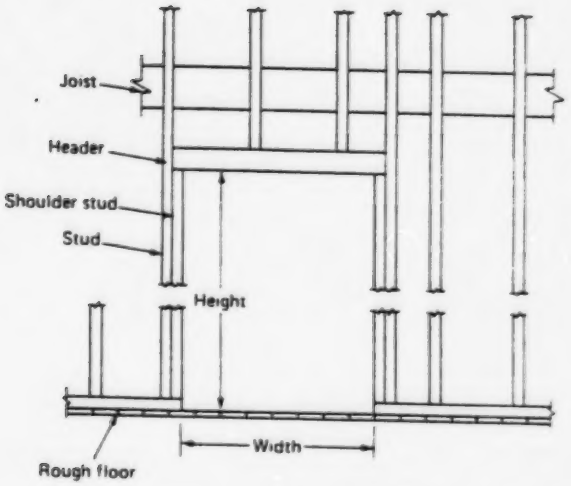
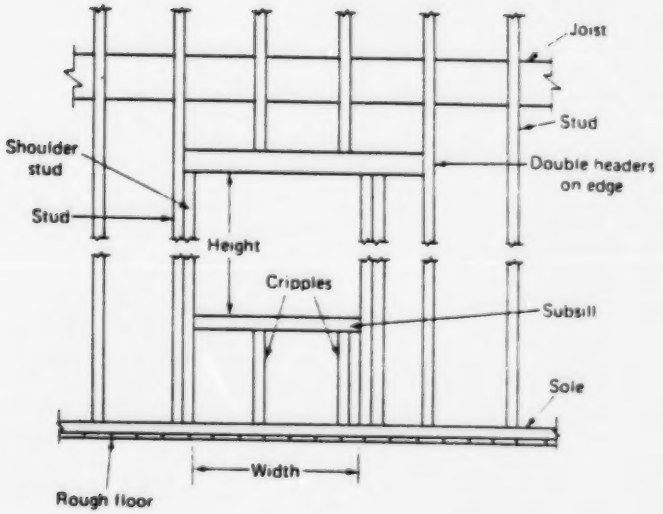


Diagram12

WALL FRAMING AND DETAIL



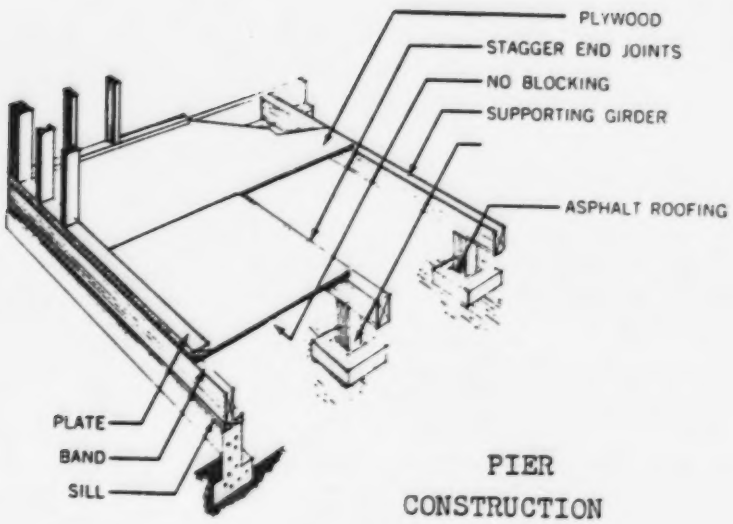
DOOR FRAMING



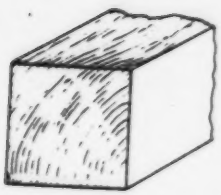
WINDOW FRAMING

Diagram13

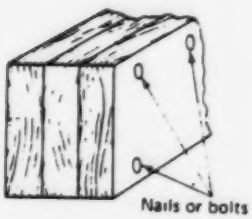
SUPPORTS AND FLOORS



PIER CONSTRUCTION



Solid wood beam



Built-up wood beam

Steel beam ("I" beam)

TYPES OF BEAMS

FINISH FLOORS

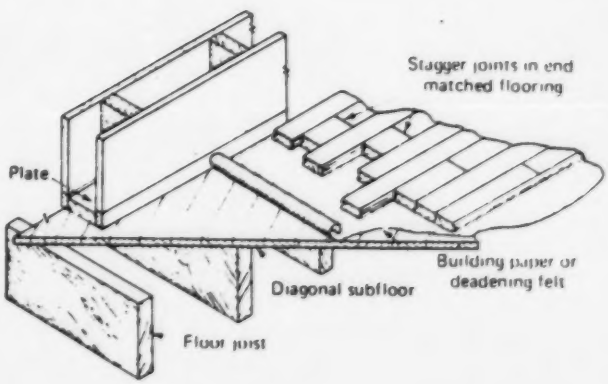
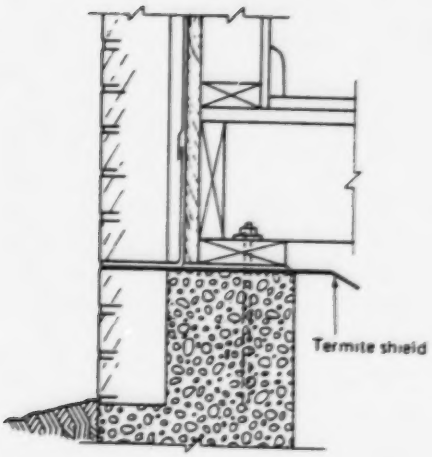
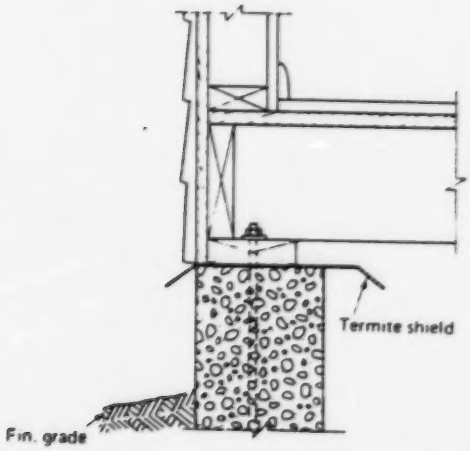


Diagram 14
TERMITE SHIELDS



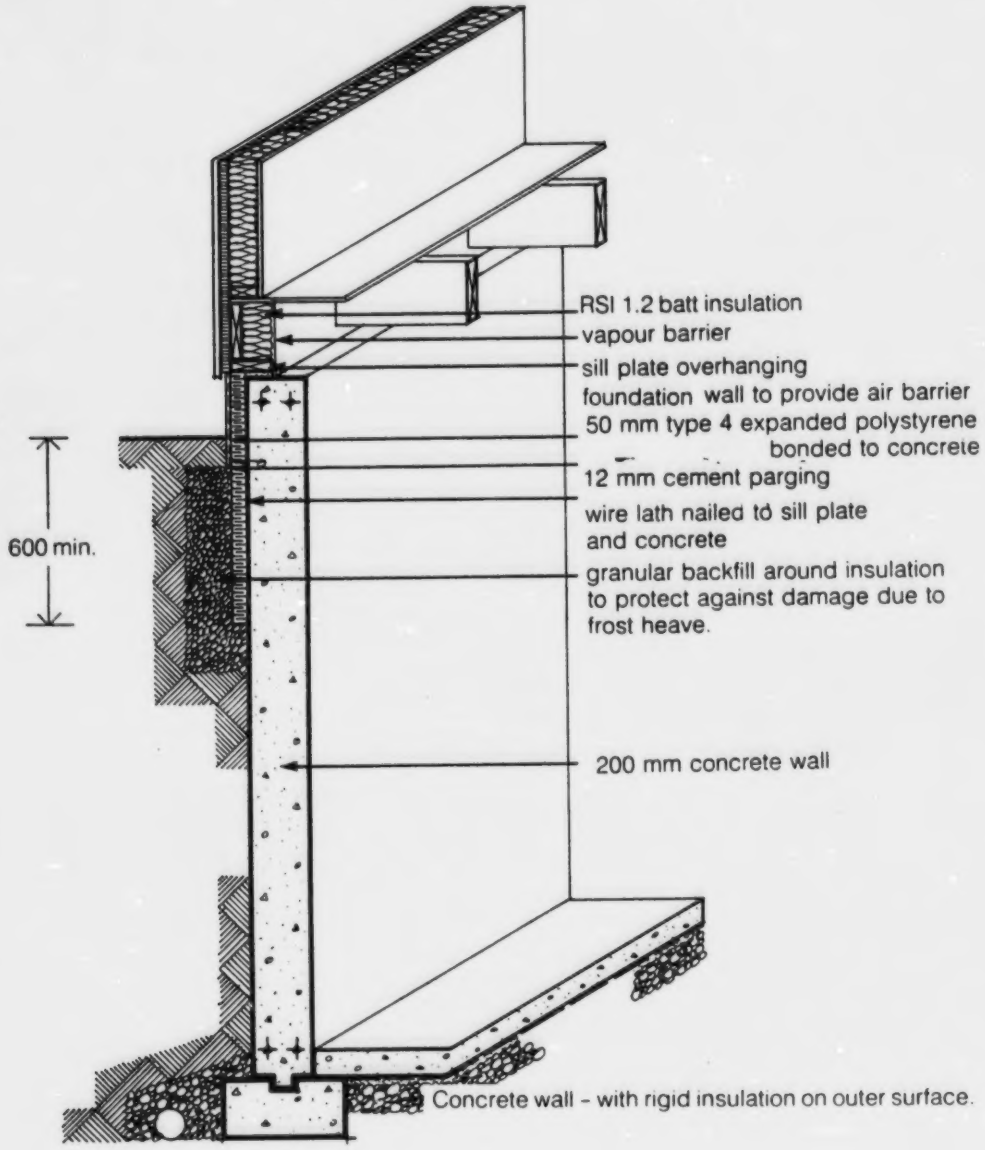
BRICK VENEER CONSTRUCTION



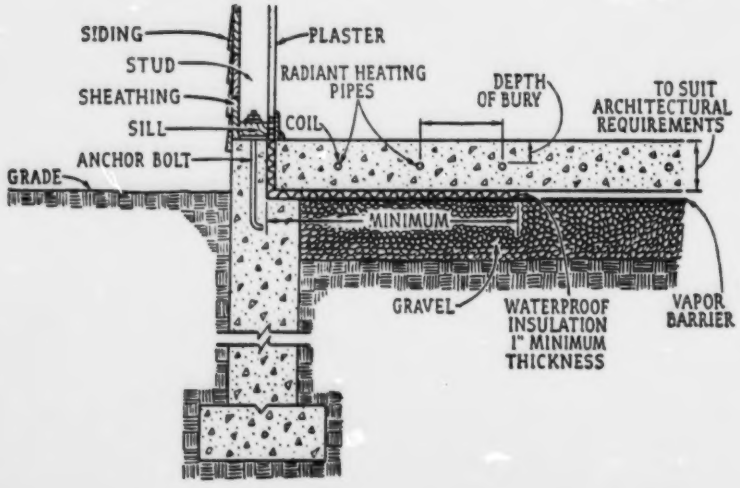
WOOD FRAME CONSTRUCTION

Diagram 15

MISCELLANEOUS PROBLEMS


RSI 1.2 batt insulation
vapour barrier
sill plate overhanging
foundation wall to provide air barrier
50 mm type 4 expanded polystyrene bonded to concrete
12 mm cement parging
wire lath nailed to sill plate and concrete
granular backfill around insulation to protect against damage due to frost heave.
600 min.
200 mm concrete wall

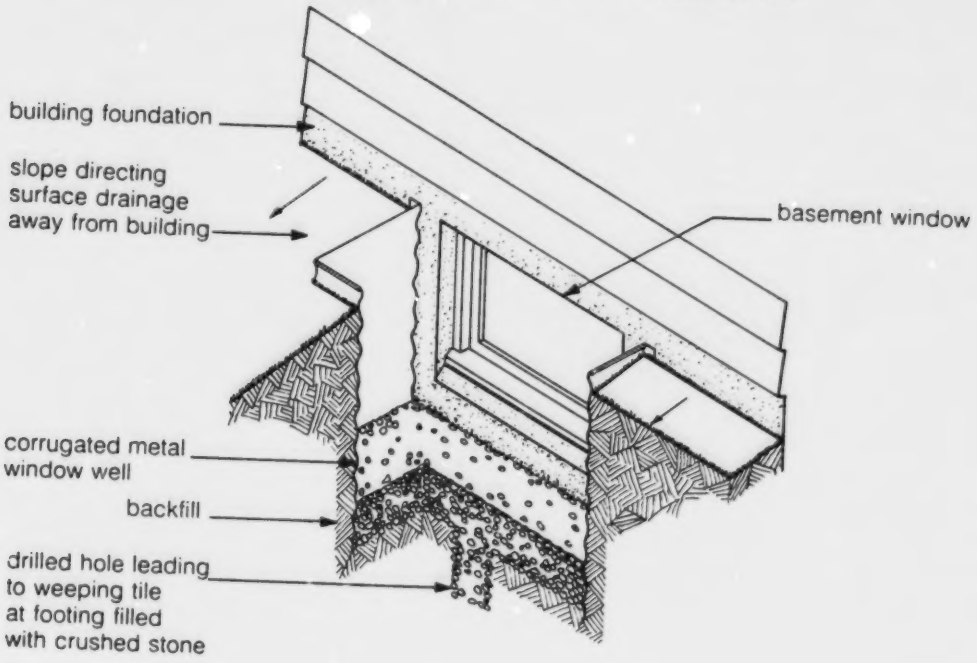
Concrete wall - with rigid insulation on outer surface.



SLAB WITH RADIANT HEATING
SUPPORTED SLAB

Diagram 16

WINDOWS Window well at basement wall.


building foundation
slope directing surface drainage away from building
basement window
corrugated metal window well
backfill
drilled hole leading to weeping tile at footing filled with crushed stone

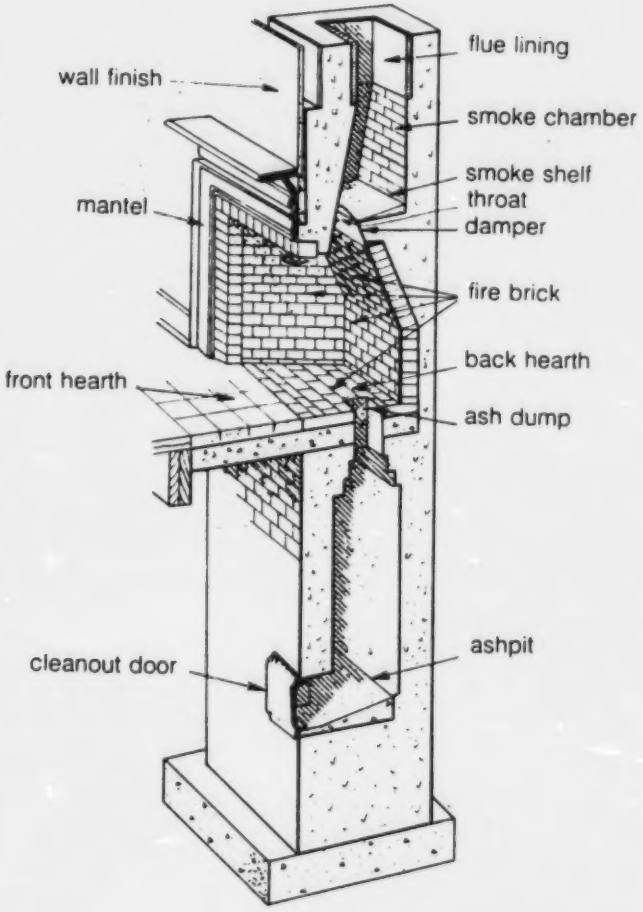


Diagram 17

Terms used in fireplace construction.

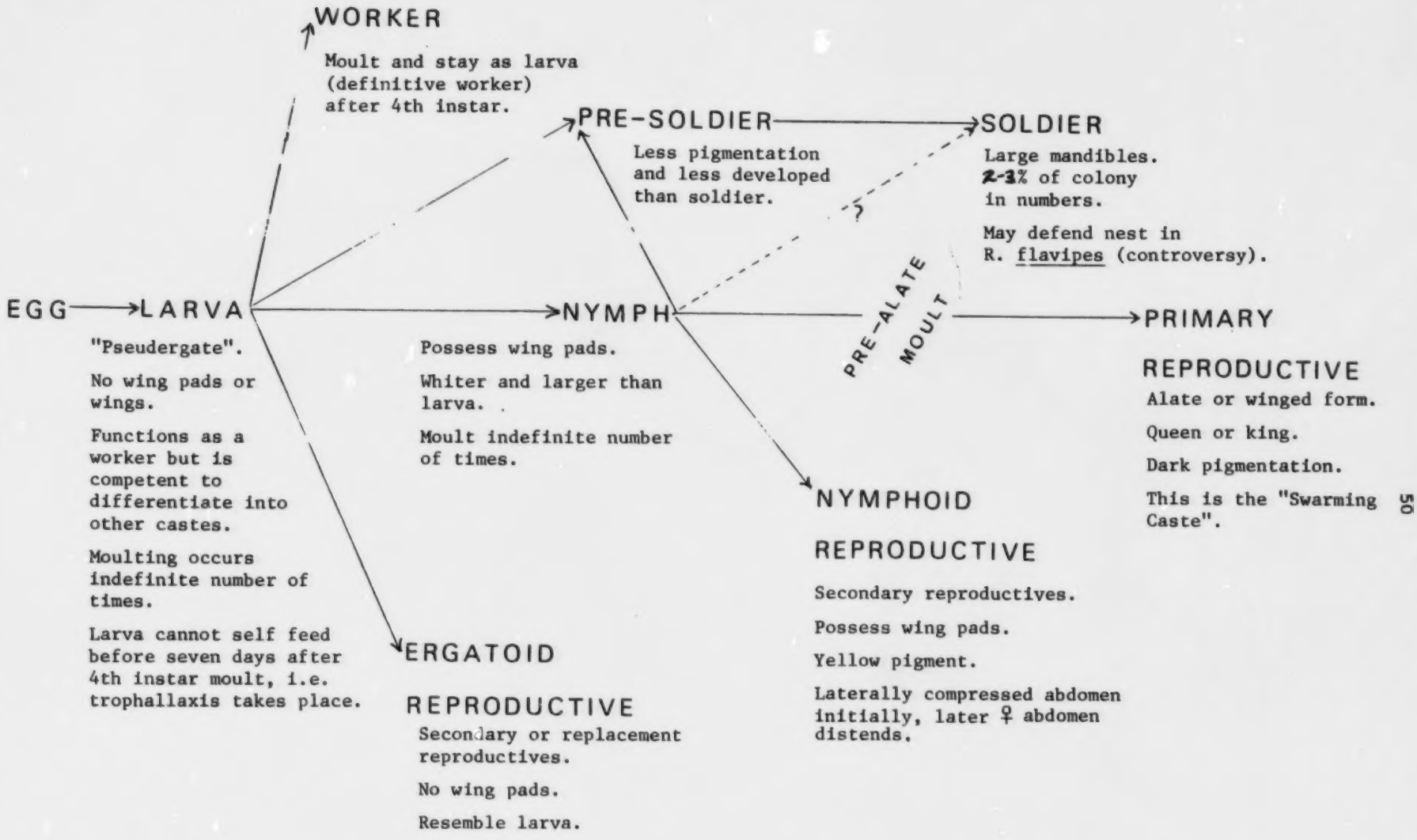

WORKER
Moult and stay as larva (definitive worker) after 4th instar.
PRE-SOLDIER
Less pigmentation and less developed than soldier.
SOLDIER
Large mandibles.
2-3% of colony in numbers.
May defend nest in R. flavipes (controversy).
EGG
LARVA
"Pseudergate".
No wing pads or wings.
Functions as a worker but is competent to differentiate into other castes.
Moulting occurs indefinite number of times.
Larva cannot self feed before seven days after 4th instar moult, i.e. trophallaxis takes place.
NYMPH
Possess wing pads.
Whiter and larger than larva.
Moult indefinite number of times.
PRE-ALATE MOULT
PRIMARY REPRODUCTIVE
Alate or winged form.
Queen or king.
Dark pigmentation.
This is the "Swarming Caste".
NYMPHOID REPRODUCTIVE
Secondary reproductives.
Possess wing pads.
Yellow pigment.
Laterally compressed abdomen initially, later ♀ abdomen distends.
ERGATOID REPRODUCTIVE
Secondary or replacement reproductives.
No wing pads.
Resemble larva.

Diagram 18 Life cycle of Subterranean termite

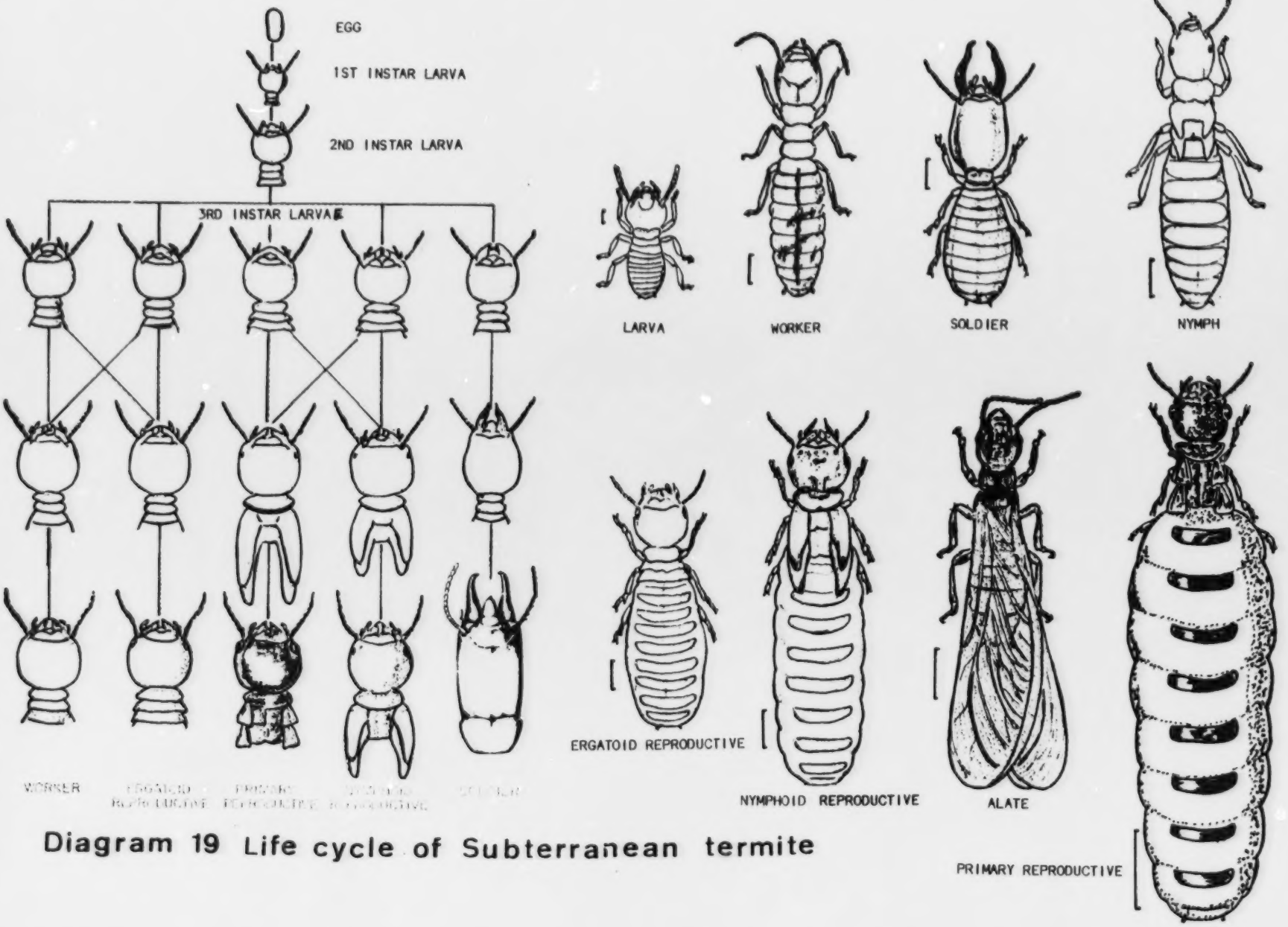


Diagram 19 Life cycle of Subterranean termite

APPENDIX 1

SOIL COVERS AND TERMITE CONTROL TREATMENT

A large number of older homes in Ontario contain crawl-spaces beneath living areas. In a few such older homes, ventilation is adequate to allow for sufficient moisture control. However, with the increase of fuel costs and the increase in insulation such moisture is prevented from escaping. When older homes are remodeled, the crawl-space area often is enclosed by brick veneer reducing air ventilation under the house. In many cases, the soil in the crawl space is in direct contact with the wood members of the structure. The result? Ideal conditions for wood decay and a situation conducive to termites. Not only does the lack of wood-soil clearance provide for moisture problems, it also reduces inspection accessibility of such areas.

The major purpose of a soil cover is to keep the moisture from moving upward through the soil to the wooden floor members of the house. Soil covers are often referred to as vapour barriers, moisture barriers, or ground covers. Primarily they are a polyethylene sheet of 4 - 6 mil: however, roll roofing or kraft paper with plastic backing can also be utilized.

The Ministry of the Environment, under the Termite Control Treatment Guidelines requires the area in a crawl space to be excavated and leveled to allow for adequate inspection and chemical treatment (45 cm - 60 cm clearance between soil and wood joists).

When pesticides are applied in crawl spaces with exposed soil in which a heated living space exists above, vapours may be carried to the living space. Proper ventilation and a soil cover applied after the soil has been leveled and rodded with pesticide will reduce any possible vapour problem.

Before installing a soil cover, the drainage of the site should be determined. No water should be standing in the area. A sump pump or drainage ditch or perimeter tile bed etc. should be utilized if such conditions exist. Damp proofing the outside of the foundation wall from the footings to the grade line and installing a moisture proof membrane against the supporting soil is also recommended, if practical. Remember, solve the drainage problem <u>before installing</u> the soil cover. Otherwise, more harm than good will result.

Air conditioning units in houses with crawl spaces can also be a problem. When the warm air underneath reaches the cooler floor surface, moisture will condense on floors and joists.

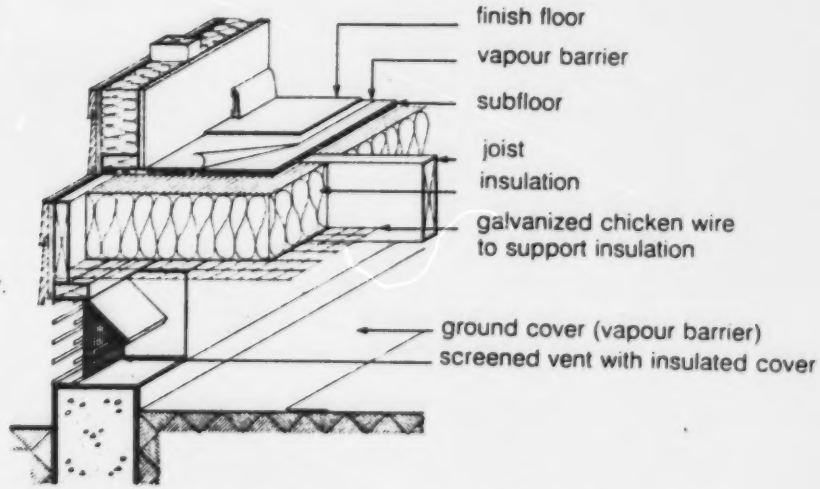
A major cause, as mentioned earlier, for increased moisture in crawl space areas is lack of ventilation. At least four air vents should be installed opposite each other to provide cross-circulation, and as close to corners as possible to prevent dead air pockets. These vents should not be blocked on the outside. Vents can be closed in winter if a soil cover has been properly installed and insulation bats are placed between joists.

The installation of the soil cover and termite treatment involves six basic steps. These are as follows:

1. The removal of all debris and replacement of wood with non-cellulose material in the crawl space area.
2. The removal of soil to permit at least 45-60 cm clearance between wood and soil.
3. The levelling of soil and proper drainage practices initiated.
4. The chemical treatment of the soil by a licenced pest control company in which termiticides are rodded (<u>not flooded</u>) by a probe into the soil, along the perimeter of foundation walls, all support posts and exposed soil.
5. The laying down of a 4-6 mil vapour barrier.
6. The installation of adequate ventilation.

To install a soil cover follow the following three steps (see the diagram below):

(a) Unroll the soil cover and lay the cover down directly onto the soil.
(b) Overlap the edges slightly (there is no need to seal the laps or edges against foundation walls or piers).
(c) Anchor the soil cover with heavy rocks, bricks, blocks, etc.



Crawl-space vent and ground cover.

Exclusion of animals to the crawl space area should be done with non-cellulose material such as fibre glass or metal. Inspection door access is essential to provide monitoring of the termite control treatment.

APPENDIX 11

The Use of Blueprints As An Aid to Proper Termite Control.

Many municipalities require pre-treatment for new construction to prevent possible termite infestation. In many cases, entire housing or industrial complexes have to be treated chemically. In order for a pest control company to estimate costs properly it must know how much chemical is required and where it is to be applied. In other words, to treat such areas satisfactorily the pest control technicians must know how to read blueprints. It is impossible to learn everything about blueprint reading from the one blueprint example attached to this booklet; (Figs. 1-6) however, in conjunction with some practical experience, you can learn to interpret adequately the majority of construction plans in Ontario.

First of all, what are blueprints? Blueprints or plans are the working drawings used by the architect to explain, in pictorial form, his concepts to the builder. The set of blueprints shows all dimensions of rooms, location of interior partitions, plumbing, electrical fixtures, type of construction and many other factors needed to build the structure.

Most blueprints also give a pictorial view (elevation view) of the structure which enables you to achieve an overall concept of how the structure will look on completion (See Figures 3 and 4). The plot plan, foundation/basement plan, floor plans and roof plan are shown as top views. When looking at any of these views imagine yourself looking straight down from a high position where you see only the top plane of the object.

Since the architect is drawing the structure in a single plane only, every part of the structure must be shown in relation to other parts i.e. all surfaces are represented whether they can be seen or not. This is achieved by the use of dotted lines on the architects plans. On many plans, for example, the roof overhang is outlined on the floor or foundation plans. Breaklines are also shown in many elevation diagrams to show cross sections of uniformly long areas which, if drawn in their entirety, and to scale, would be too large for the paper. Fig. 4 illustrates this technique.

The majority of building materials are also represented by standardized symbols, although there may vary on some blueprints (An explanation of symbols are given on most blueprints). Diagrams #1-3 demonstrate the electrical, plumbing and other symbols used in architectural building plans.

These symbols aid the pest control company in determining the amount of chemical required to properly pre-treat a property. For example: more chemical would be required to treat a property with void block walls than one with poured concrete walls since in the former case the wall voids must be treated. (See guidelines for pre-treatment in the Termite Control in Ontario publication.)

The majority of building plans are still drawn in imperial measurements. With the progression to the metric system, building plans will eventually be drawn in metric units (millimeters). Since labels of registered pesticides are already in metric units the conversion of building plans to metric will make calculations much simpler.

Section views are included with all blueprints and show cross sections or end views of vertical parts of the structure. For example, Figure 3 shows (WI) joined to (WI) by means of a dashed line with instructions to see sheet 5. Turning to sheet 5 we see a typical cross section giving specific details of construction.

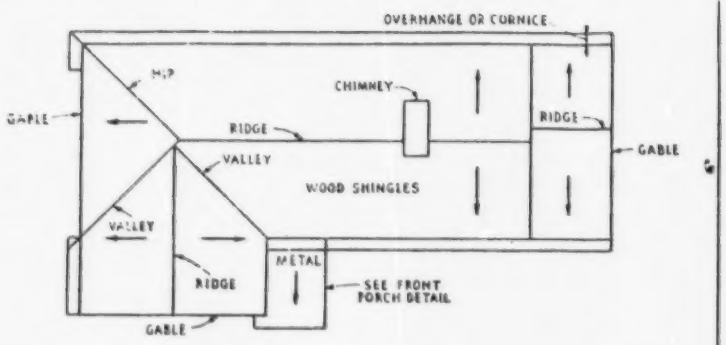
The use of building plans is not limited to pre-construction treatment for termites. If termites invade a building after construction, blueprints become an invaluable aid to detecting wall voids and other hidden areas where treatment should take place. Obviously, in large buildings, major utility lines for plumbing, electricity and gas must be located before drilling takes place to prevent damage.

The following example will show how to calculate chemical quantity for a specific area of a building blueprint. Fig. 2 shows the plans for the basement of the house to be constructed. Prior arrangements with the builder would allow your company to treat the required areas before the concrete slab is poured or prior to backfilling. Example: How much formulation would be required in the unexcavated area marked A of Fig. 2?

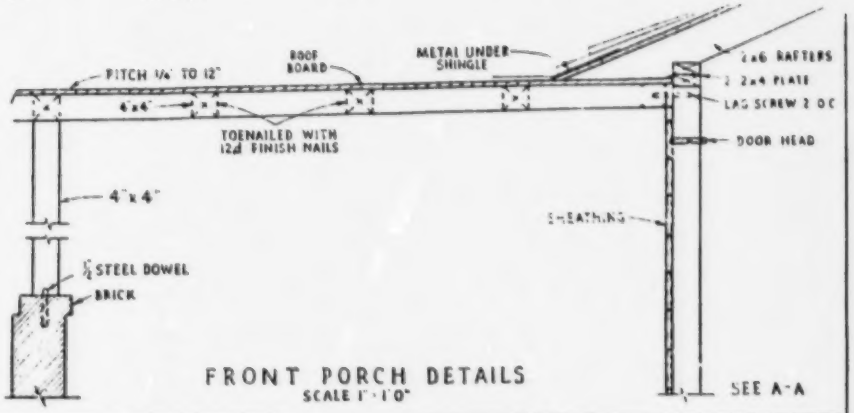
Both label and Ministry of the Environment recommendations state that 5 litres/m^2 of formulation should be applied since this area will be covered by a 4" (10 cm) slab. Total area of this unexcavated section is 24'6" X 28'2" = approx. 694 sq. feet, less the area of the smaller unexcavated section 5'10" X 8'0" = approx. 41 sq. ft. therefore, 694-41 = 653 sq.ft. As stated earlier, the majority of building blueprints are in imperial measurements and all new pesticides labels are in metric units so conversion of the dimension of the area to be treated is necessary before the total amount of formulation can be estimated.

Since 1 square foot = 0.093 square metres
653 square feet = 60.7 square metres

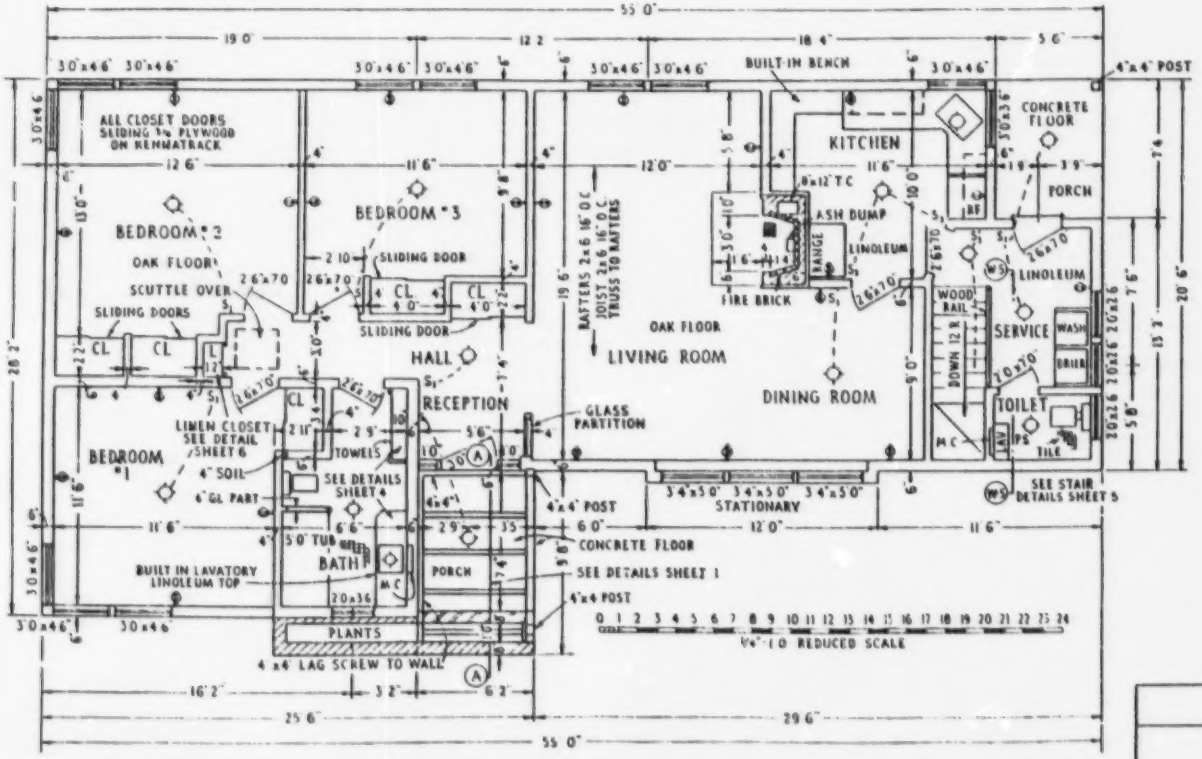
at 5 litres/m^2 a total of 60.7 X 5 = 304 litres of chemical formulation will be required beneath the slab.



ROOF PLAN
SCALE 1/8" = 1'-0"



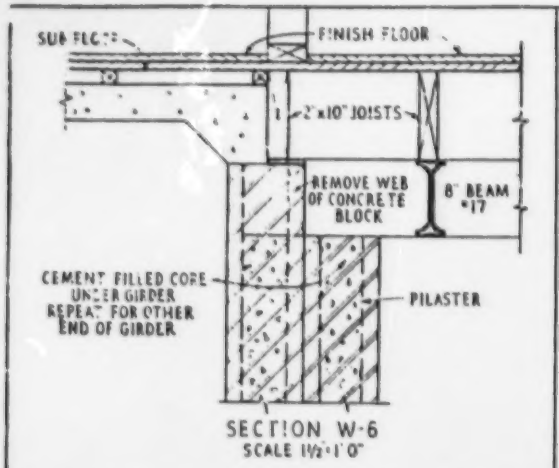
FRONT PORCH DETAILS
SCALE 1"=1'-0"



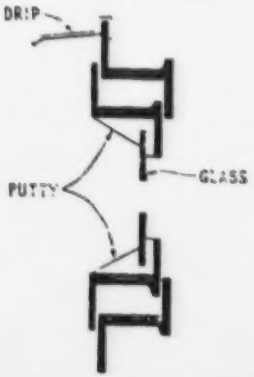
FIRST FLOOR PLAN
SCALE 1/4"=1'-0"

Fig.1

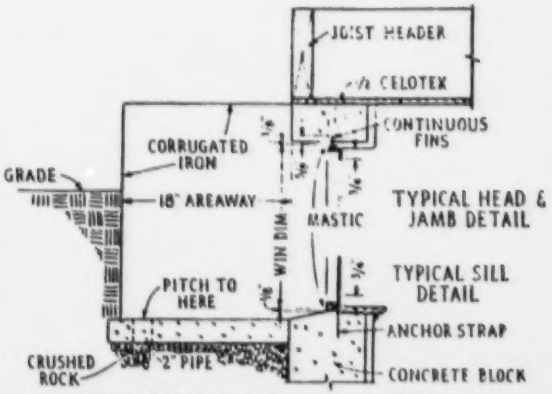
1 OF 6 SHEET
709 F FILE



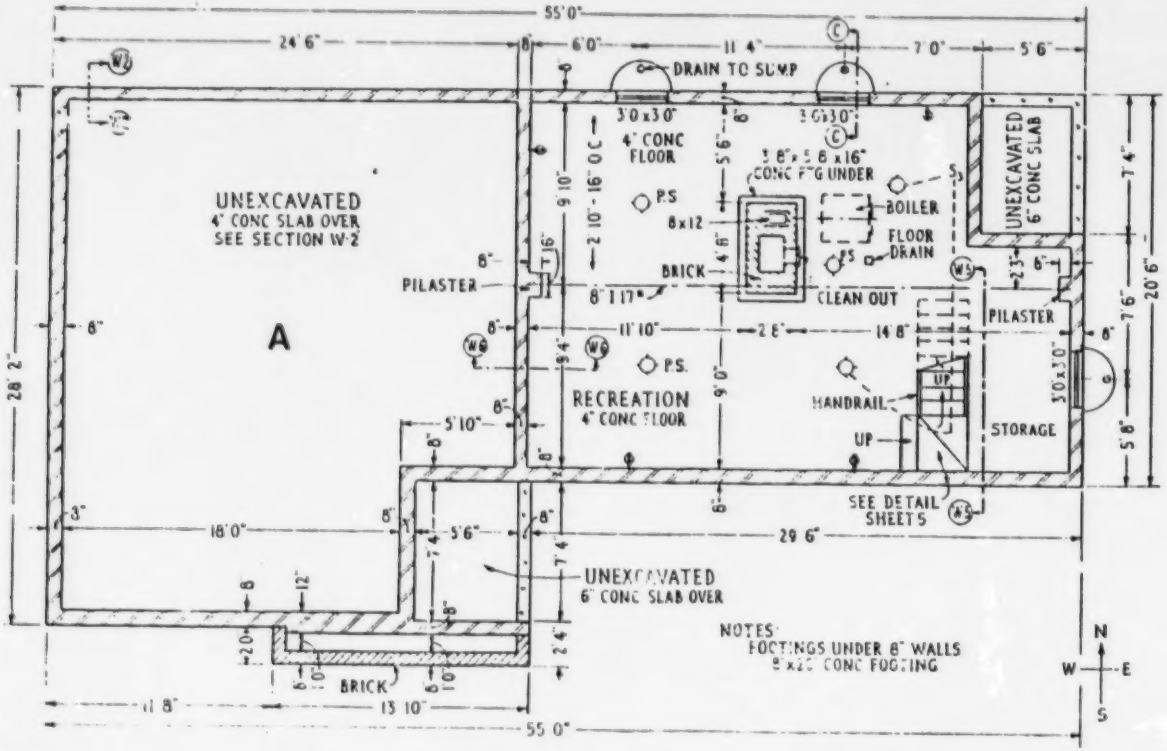
SECTION W-6
SCALE 1½"=1'0"



F S SECTION THRU METAL SASH AND FRAME IN SECTION C-C



STEEL FRAME & AREAWAY - SECTION C-C
SCALE ¼"=1'0"



DR CH REVISIONS	BASEMENT Fig. 2	SCALE 1/4"=1'0" SHEET 2 OF 6 FILE 709

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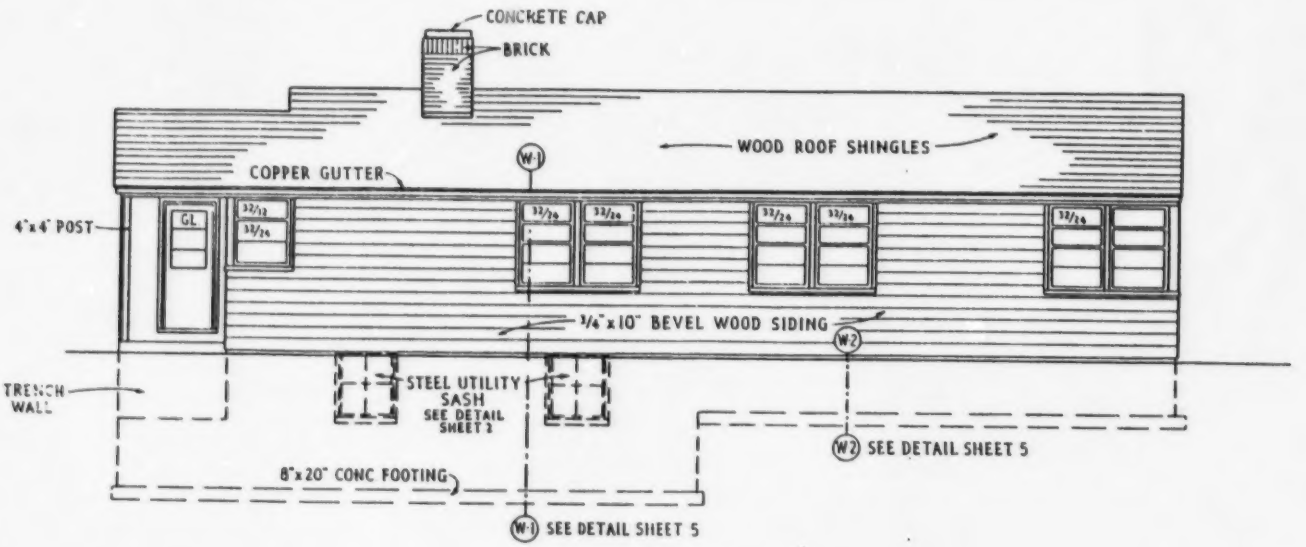
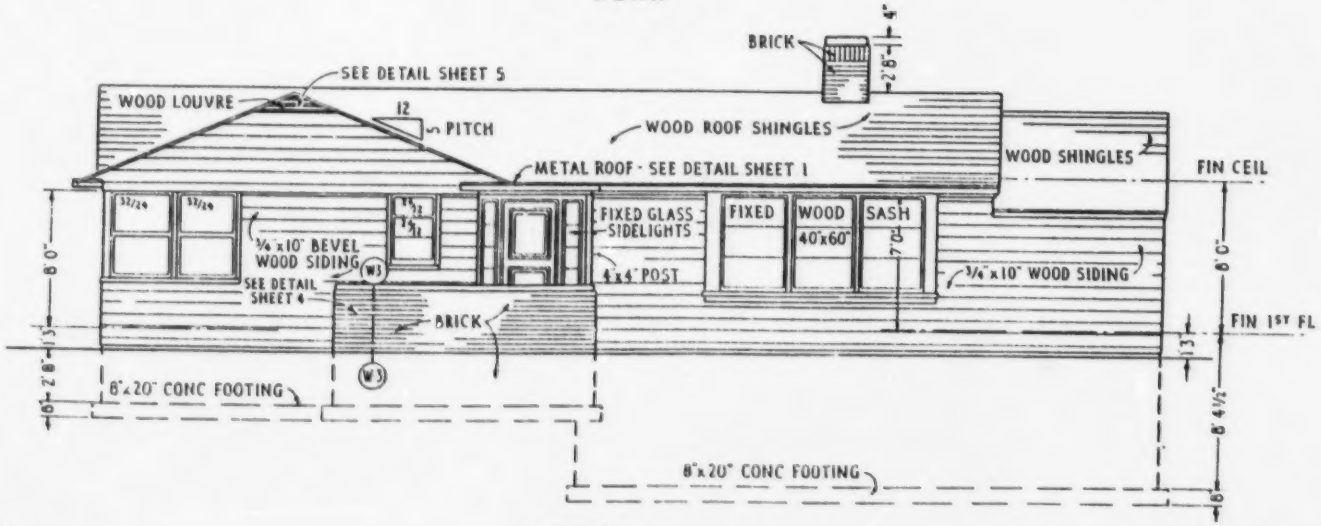
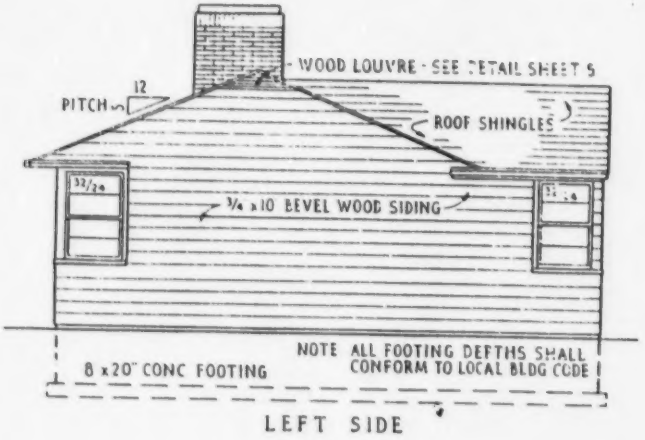


REAR

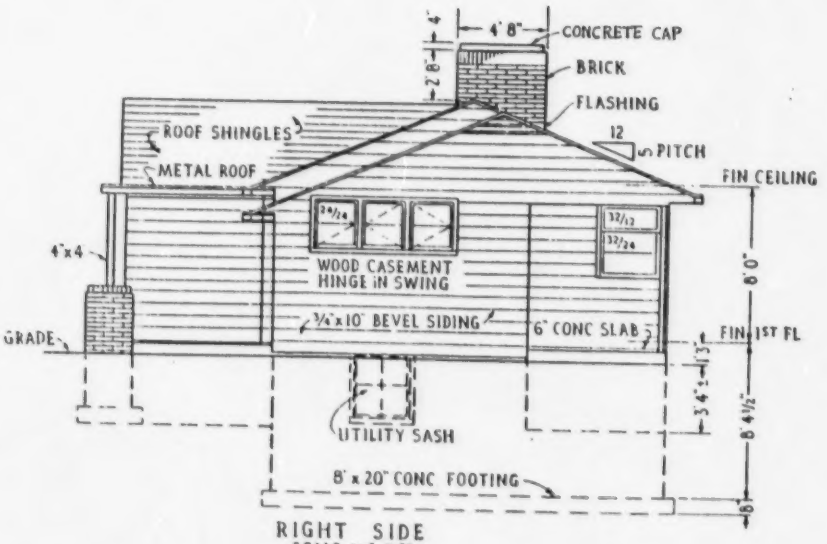


FRONT

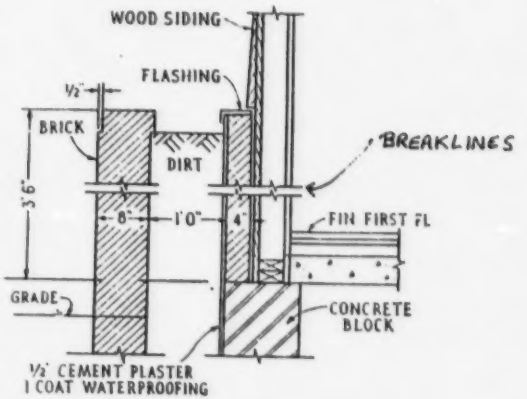
DR CH	ELEVATIONS	SCALE 1/4" = 1'-0"
REVISIONS	Fig.3	SHEET 3 OF 6
		FILE 7065


WOOD LOUVRE - SEE DETAIL SHEET 5
PITCH 12
ROOF SHINGLES
¾ x 10 BEVEL WOOD SIDING
NOTE ALL FOOTING DEPTHS SHALL CONFORM TO LOCAL BLDG CODE
8 x 20" CONC FOOTING

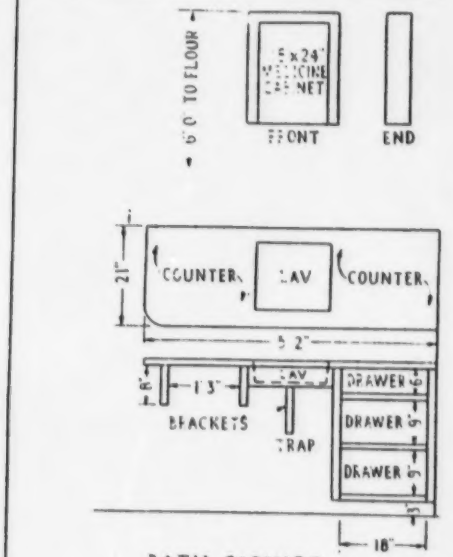
LEFT SIDE



RIGHT SIDE
SCALE ¼" = 1'0"



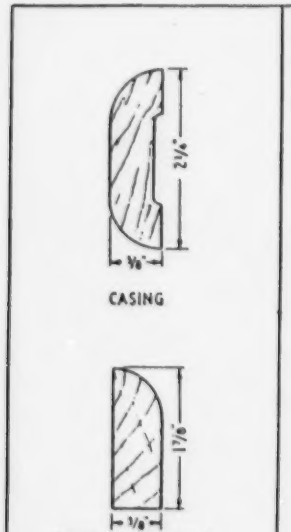
SECTION W-3
1" = 1'0"
SEE FRONT ELEVATION



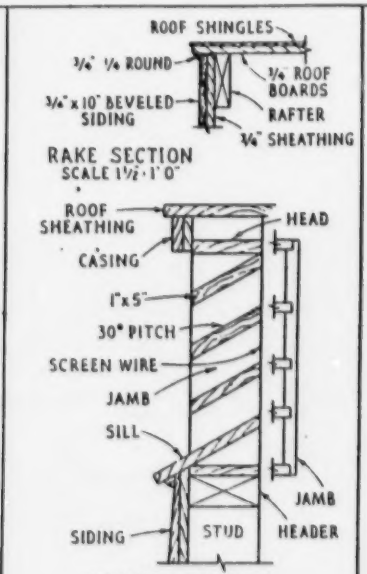
BATH CABINET
SCALE ¾" = 1'0"

60

DR CH REVISIONS	ELEVATIONS Fig.4	SCALE ¼" = 1'0" SHEET 4 OF 6 FILE 709

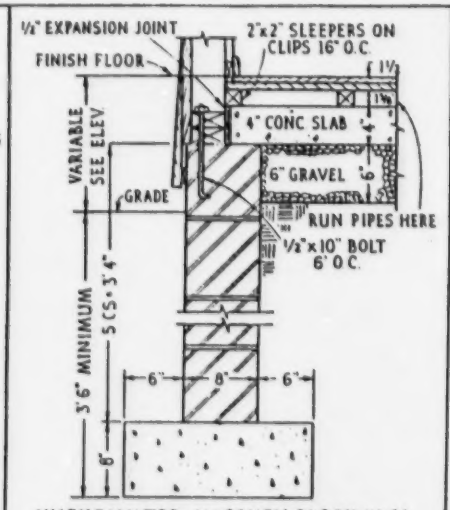


F S D INTERIOR TRIM



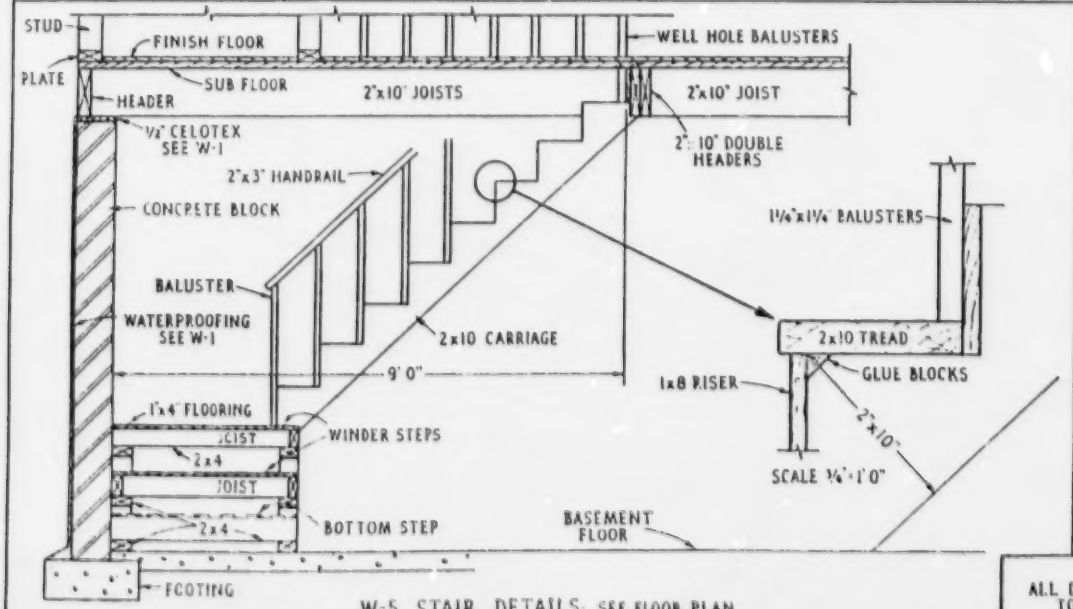
RAKE SECTION
SCALE 1½"=1'0"

LOUVRE SECTION
SCALE 3"=1'0"

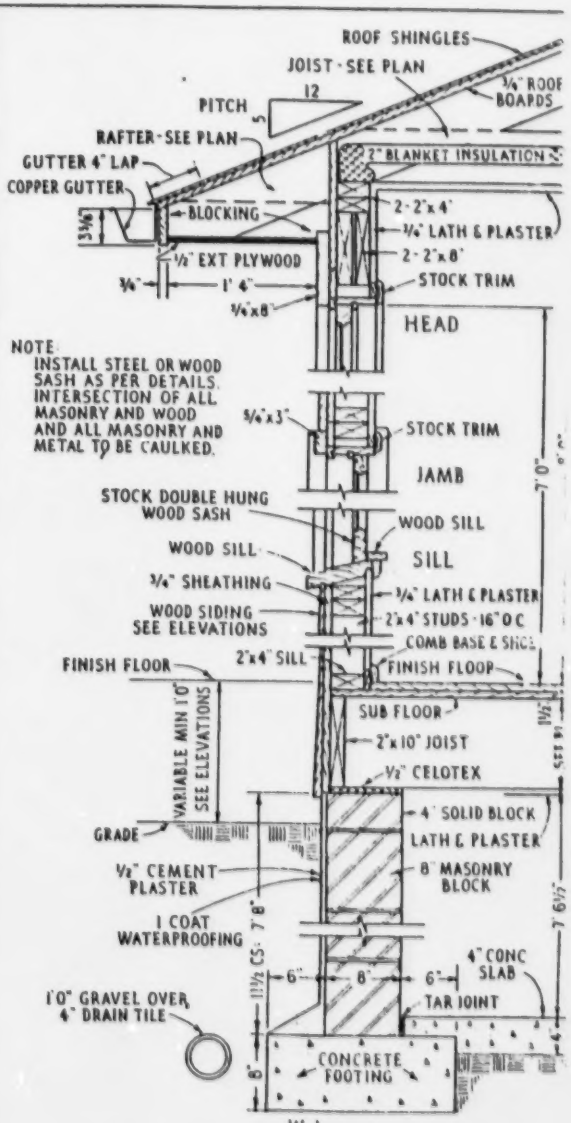


UNEXCAVATED MASONRY BLOCK WALL
CONC SLAB WITH WOOD FLOOR
W-2

ALL NOTES TYPICAL WALL SECTION APPLY UNLESS OTHERWISE INDICATED



W-5 STAIR DETAILS SEE FLOOR PLAN
SCALE ¼"=1'0"



W-1
TYPICAL WALL SECTION FOR EXCAVATED AREA
SCALE 1½"=1'0"

ALL DETAILS SUBJECT TO LOCAL CODE REQUIREMENTS

DR
CH
REVISIONS

CONSTRUCTION SECTION

SCALE AS S

SHEE 5 OF

Fig.5

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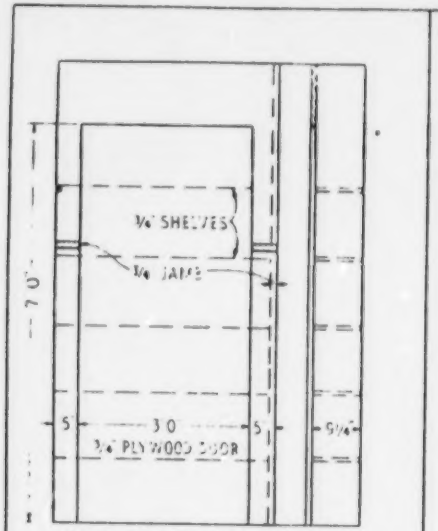
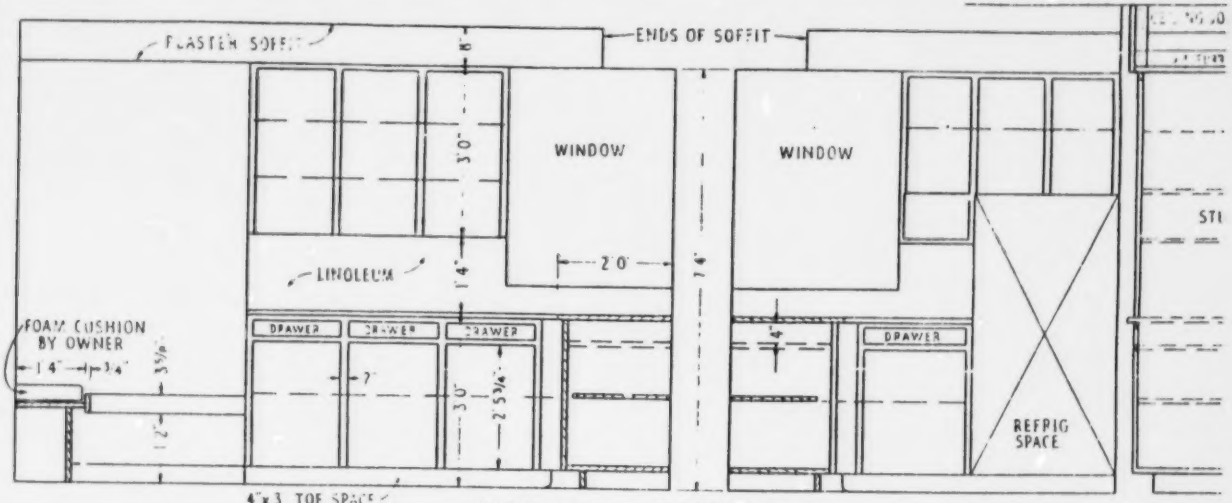
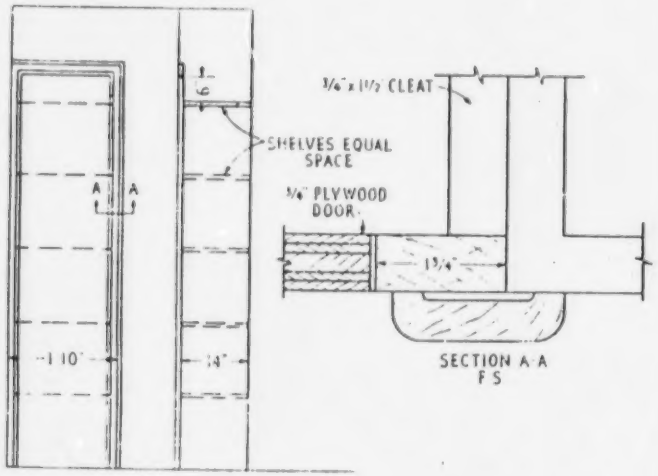


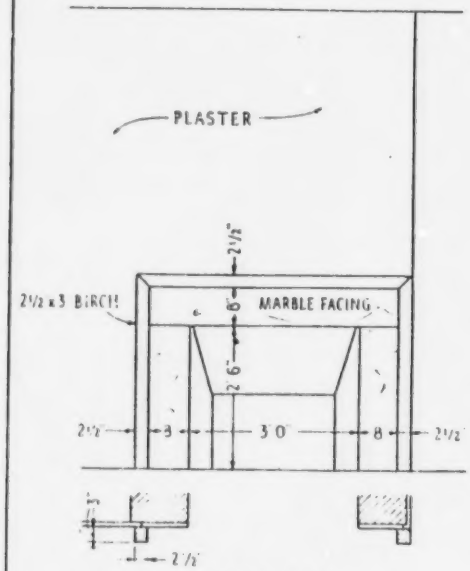
TOWEL CABINET IN BATHROOM



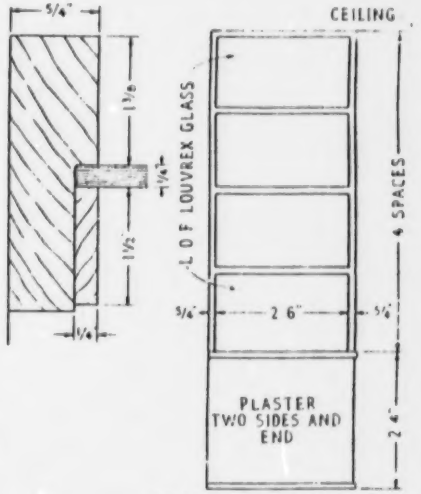
KITCHEN CABINETS



LINEN CLOSET IN HALL



FIREPLACE



GLASS PARTITION
(BATH & HALL)

DR	INTERIOR DETAILS	SCALE 3/4"
CH		
REVISIONS	Fig.6	SHEET 5 OF 6

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REFERENCE SECTION

BUILDING MATERIAL SYMBOLS

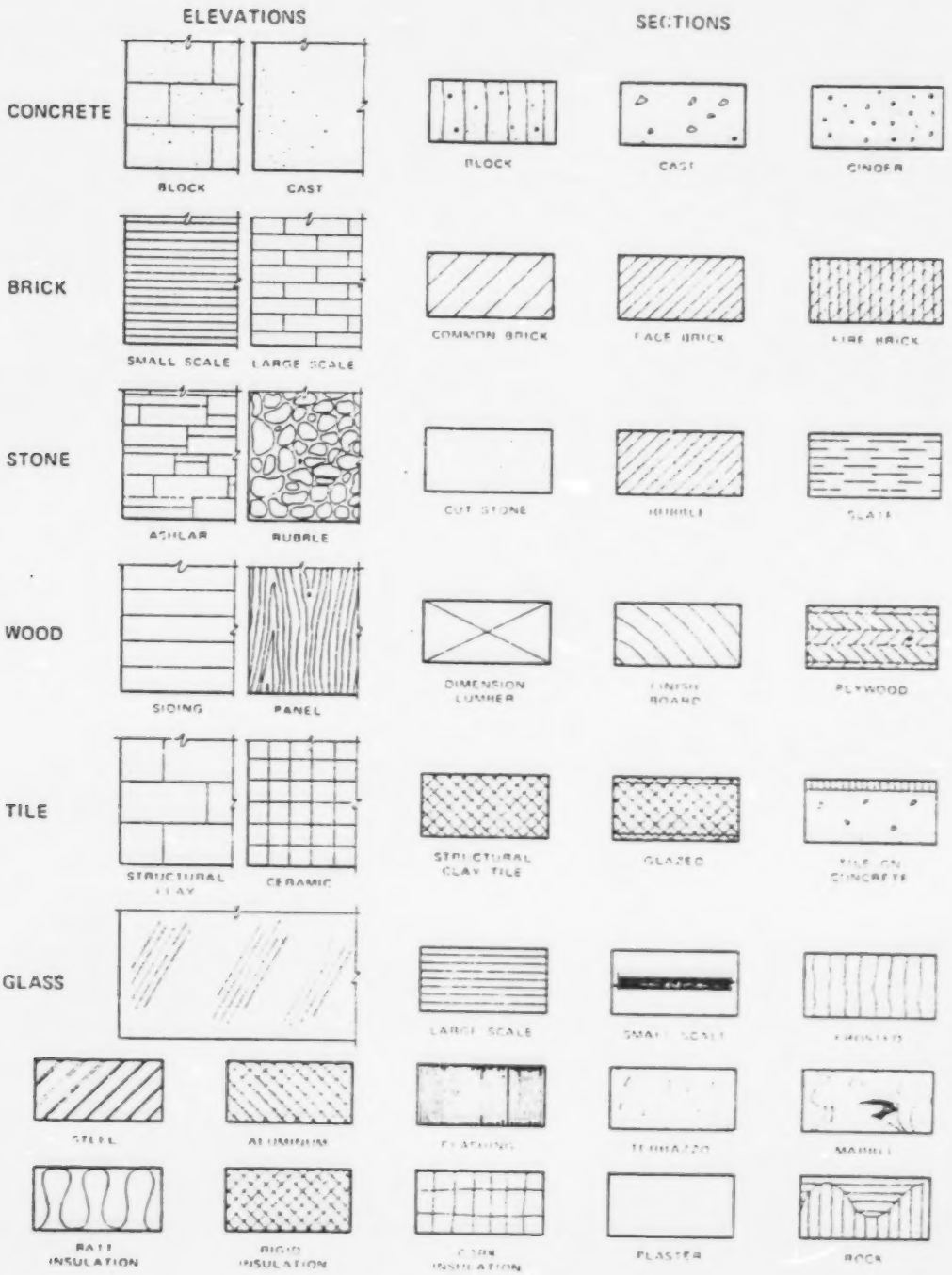
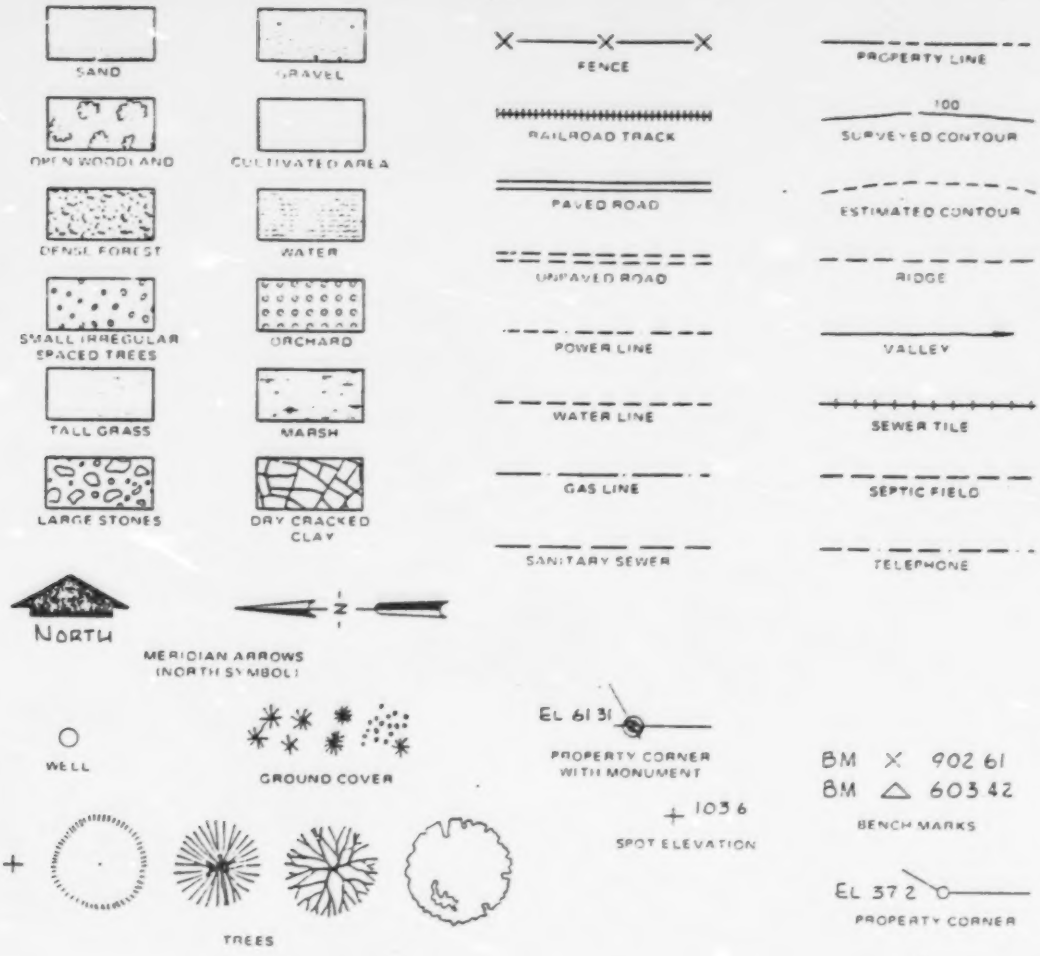


Diagram 1



PLUMBING SYMBOLS

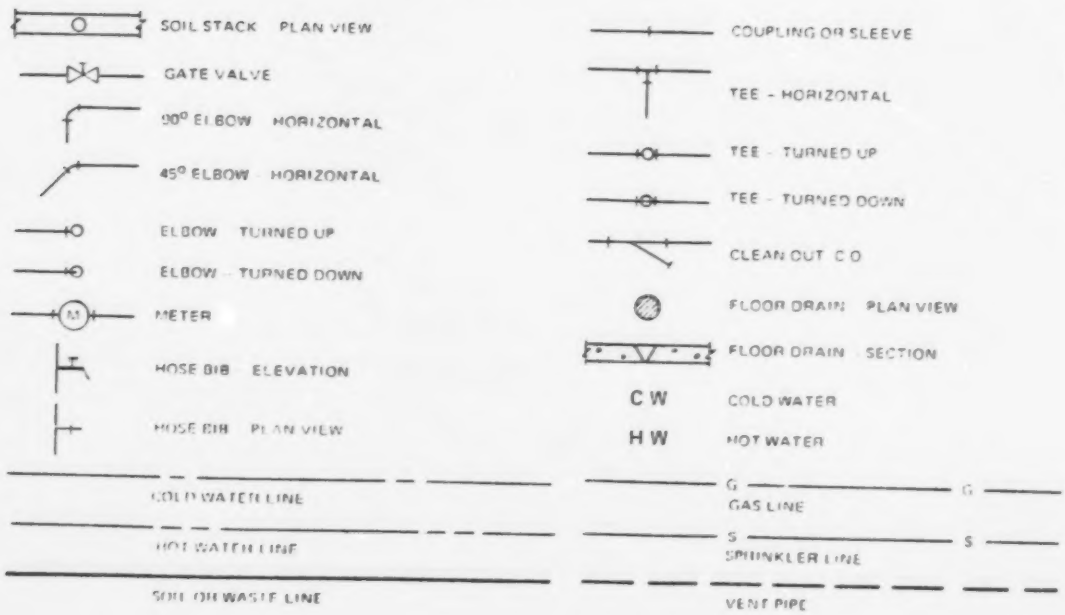
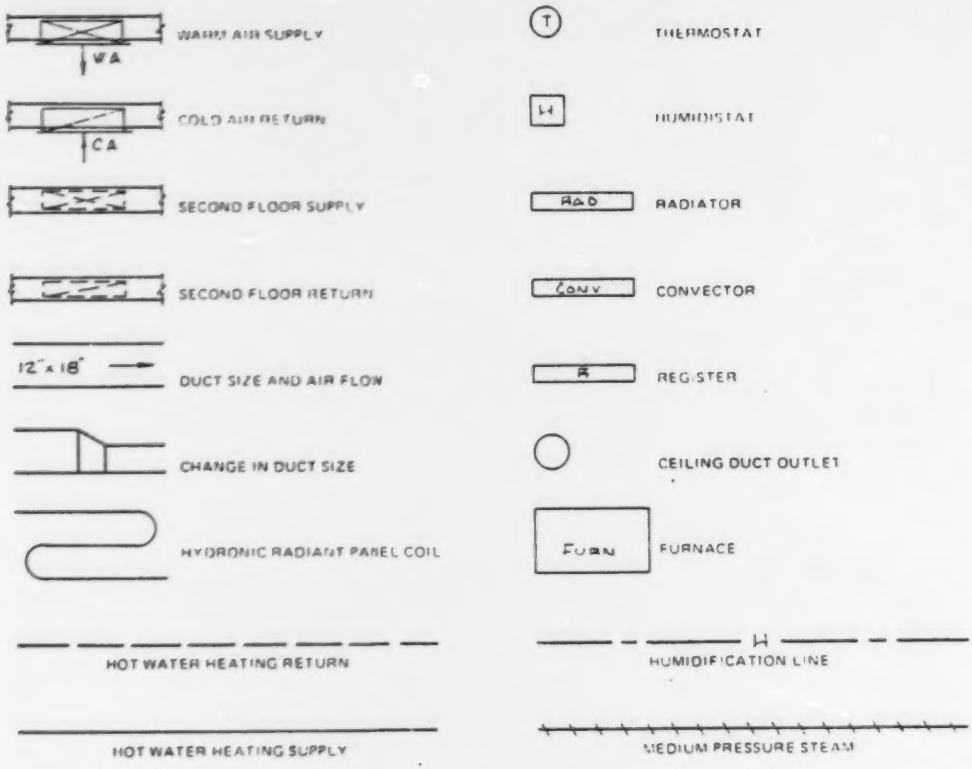


Diagram 2



ELECTRICAL SYMBOLS

Diagram 3

Revised January 1986

SATISFACTORY COMPLETION CERTIFICATE FOR CHEMICAL TERMITE CONTROL TREATMENT

MUNICIPALITY _____ DATE _____

INSPECTOR'S NAME _____

PROPERTY ADDRESS _____ OWNER OR TENANT: _____

PEST CONTROL CO. NAME _____

CREW FOREMAN'S NAME _____ FILE NO. _____

Caution: Pesticide should not be applied in such a manner as to create a condition of continued exposure nor in a manner to create a hazard to the applicator.

		Check One		
		Yes	No	Not Required
1.	All wood/soil contact has been removed prior to chemical treatment.	___	___	___
2.	Holes, spaced 20cm.-45 cm. apart, have been drilled into the outside foundation wall voids above grade level, and chemical has been applied. (Approximate hold spacing for rubble walls is 45 cm, 40 cm for block walls, 20 cm for brick walls)*	___	___	___
3.	Holes have been drilled into foundation wall below all basement windows and chemical injected.	___	___	___
4.	Chemical has been injected by rodding at 20-45 cm intervals from grade to foots around entire perimeter of structure.	___	___	___
5.	Soil surrounding garages, trees and fence posts has been treated by rodding around perimeter.	___	___	___
6.	All outside masonry stairs have been drilled, and chemical applied to each riser or tread.	___	___	___
7.	All outside pre-cast concrete steps have been drilled to allow chemical treatment of soil beneath and behind unit.	___	___	___
8.	All brick or cement-block porch support piers have been drilled and treated into interior void, and soil treated on all sides around base.	___	___	___
9.	All unexcavated areas and crawl spaces, including under porches have been cleared of debris, soil levelled to give 50 cm clearance or more ** and soil probed to ensure chemical treatment. Proper ventilation and a vapour barrier has been installed in unexcavated areas below living spaces.	___	___	___
10.	Holes, spaced 30cm.-40cm. apart, have been drilled around entire floor perimeter of basement, and chemical injected under basement floor slab by sub-slab injector.	___	___	___
11.	Holes, spaced 30 cm.-40 cm. apart, have been drilled into slabs along one side of all partition walls, and along both sides of interior bearing walls, and chemical injected beneath basement floor slab by sub-slab injector.	___	___	___

	Check One		
	Yes	No	Not Required
12. Holes, spaced 20 cm.-45 cm. apart, have been drilled into all inside bearing walls with voids above interior floor level, and chemical has been applied. (required only if active infestation in wall exists).	___	___	___
* (a) If foundation wall or bearing wall is of rubble construction, test holes have been drilled to check for voids, and chemical has been injected where possible.			
13. All support piers with voids have been drilled chemically and treated into interior void, and beneath slab on all sides around base.	___	___	___
14. Drill holes have been made in the basement slab to allow chemical treatment where it meets the stairway stringers and support posts.	___	___	___
15. All major cracks along the indoor basement slab have been drilled and chemically treated.	___	___	___
16. All drill holes have been thoroughly sealed by means of plastic plugs or good quality mortar.	___	___	___

17. Total amount of formulation used. _____ (specify gallons or litres)

* Clearance of 1 m or more may be required to allow safe access for pest control applicator.

I hereby attest that termite control treatment on this property has been completed according to the guidelines laid down by this municipality and the Ontario Ministry of the Environment.

Signed _____
Pest Control Crew
Foreman OR Supervisor

IMPORTANT: Crew Foreman: Please return this form to the municipality so that it may be signed below by the Building Inspector.

_____ _____

To the best of my knowledge, all wood soil contact removal requirements have been met and the above pest control company has completed this check list in full.

Signed _____
Building Inspector OR
Municipal Representative

Municipal inspector was on site during application. YES __ NO __

NB: If any "no's" are recorded on this checklist, adequate explanation is required. Please use the space below.

ONTARIO MINISTRY OF THE ENVIRONMENT TERMITE CONTROL PROGRAM
SATISFACTORY PRETREATMENT COMPLETION CERTIFICATE

MUNICIPALITY _____

PROPERTY ADDRESS _____ HOMEOWNER OR AGENT _____

CREW FOREMAN'S NAME _____ INSPECTOR'S NAME _____

CAUTION: Pesticide should not be applied in such a manner as to create a condition of continual exposure nor in a manner to create a hazard to the applicator.

		CHECK ONE		
		Yes	No	Not Required
1.	Chemical emulsion has been applied, by low pressure fan spray, into soil as an overall treatment under basement floor area prior to pouring of concrete.	___	___	___
2.	Chemical emulsion has been applied, by low pressure fan spray, into soil along inside of foundation walls, along both sides of partition walls, around piers and any utility service or other feature that will penetrate basement slab.	___	___	___
3.	Chemical emulsion has been applied, by low pressure fan spray or rodding into soil back-fill along the outside of foundation walls from grade to top of footings.*	___	___	___
4.	Chemical emulsion has been applied, by rodding, into soil of areas intended as crawl spaces.**	___	___	___
5.	Chemical emulsion has been applied into hollow masonery blocks of the foundation from grade to footing prior to capping.	___	___	___
6.	Amount of chemical formulation used.	_____ (specify gallons or litres)		

* Backfill should not contain cellulose debris.
** Area must be covered by a soil vapour barrier if living space is directly above.

I hereby attest that termite control pretreatment on this property has been completed according to the guidelines laid down by this municipality and the Ontario Ministry of the Environment.

Signed _____
Pest Control Crew
Foreman or Supervisor

Date _____

IMPORTANT: Crew Foreman - Please return this form to the municipality so that it may be signed below by the Building Inspector.

To the best of my knowledge, the Pest Control Company has completed this check list in full.

Signed _____
Building Inspector or
Municipal Representative

NB: If any "no's" are recorded on this checklist, adequate explanation is required. Please use the space below or reverse side if necessary.

January 1986

SATISFACTORY COMPLETION CERTIFICATE FOR BIOLOGICAL TERMITE CONTROL TREATMENT

MUNICIPALITY _____ DATE _____

INSPECTOR'S NAME _____

PROPERTY ADDRESS _____ OWNER OR TENANT _____

PEST CONTROL CO. NAME _____

CREW FOREMAN'S NAME _____ FILE NO. _____

	Check One		
	Yes	No	Not Required
1. All wood/soil contact has been removed prior to biological treatment.	___	___	___
2. Holes, spaced 20cm.-45 cm. apart, have been drilled into the outside foundation wall voids above grade level, and biological termiticide has been applied. (Approximate hold spacing for rubble walls is 45 cm, 40 cm for block walls, 20 cm for brick walls)*.	___	___	___
3. Holes have been drilled into foundation wall below all basement windows and biological termiticide injected.	___	___	___
4. Biological termiticide has been injected by rodding at 20-45 cm intervals from grade to foots around entire perimeter of structure.	___	___	___
5. Soil surrounding garages, trees and fence posts has been treated by rodding around perimeter.	___	___	___
6. All outside masonry stairs have been drilled, and biological termiticide applied to each riser or tread.	___	___	___
7. All outside pre-cast concrete steps have been drilled to allow biological termiticide treatment of soil beneath and behind unit.	___	___	___
8. All brick or cement-block porch support piers have been drilled and treated into interior void, and soild treated on all sides around base.	___	___	___
9. All unexcavated areas and crawl spaces, including under porches have been cleared of debris, soil levelled to give 50 cm clearance or more ** and soil probed to ensure biological termiticide treatment.	___	___	___
10. Holes, spaced 30cm.-40cm. apart, have been drilled around entire floor perimeter of basement, and biological termiticide injected under basement floor slab by sub-slab injector.	___	___	___
11. Holes, spaced 30 cm.-40 cm. apart, have been drilled into slabs along one side of all partition walls, and along both sides of interior bearing walls, and biological termiticide injected beneath basement floor slab by sub-slab injector.	___	___	___

	Check One		
	Yes	No	Not Required
12. Holes, spaced 20 cm.–45 cm. apart, have been drilled into all inside bearing walls with voids above interior floor level, and biological termiticide has been applied.	___	___	___
* (a) If foundation wall or bearing or bearing wall is of rubble construction, test holes have been drilled to check for voids, and chemical has been injected where possible.			
13. All support piers with voids have been drilled and treated with biological termiticide into interior void, and beneath slab on all sides around base.	___	___	___
14. Drill holes have been made in the basement slab to allow biological termiticide treatment where it meets the stairway stringer and support posts.	___	___	___
15. All major cracks along the indoor basement slab have been drilled and treated with biological termiticide.	___	___	___
16. All drill holes have been thoroughly sealed by means of plastic plugs or good quality mortar.	___	___	___

17. Total amount of formulation used. _____ (specify gallons or litres)

* Due to different types of construction, it may be possible to carry out above and below grade treatment of bearing walls from either indoors or outdoors.

** Clearance of 1 m or more may be required to allow safe access for pest control applicator.

I hereby attest that termite control treatment on this property has been completed according to the guidelines laid down by this municipality and the Ontario Ministry of the Environment.

Signed _____
Pest Control Crew
Foreman OR Supervisor

IMPORTANT: Crew Foreman: Please return this form to the municipality so that it may be signed below by the Building Inspector.

To the best of my knowledge, all wood soil contact removal requirements have been met and the above pest control company has completed this check list in full.

Signed _____
Building Inspector OR
Municipal Representative

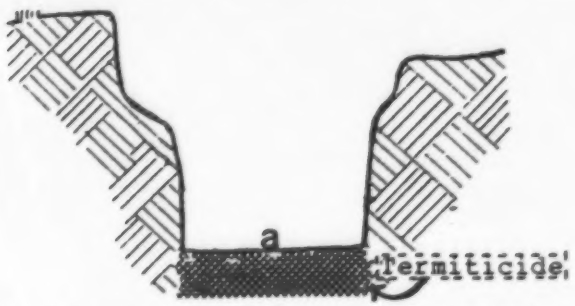
Municipal inspector was on site during application. YES __ NO __

NB: If any "no's" are recorded on this checklist, adequate explanation is required. Please use the space below.

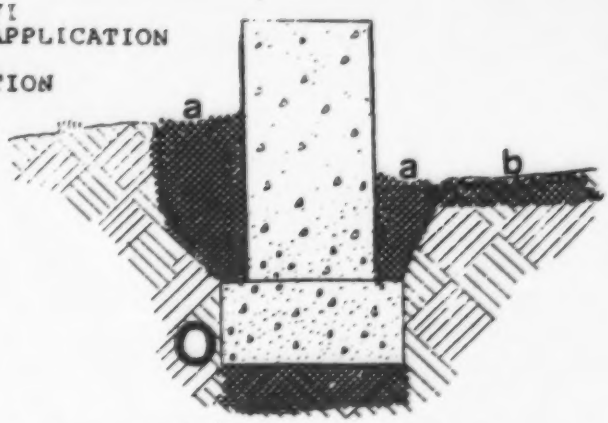
APPENDIX VI

PRE-TREATMENT RATES OF APPLICATION

A. SLAB ON GRADE-POURED CONCRETE FOUNDATION

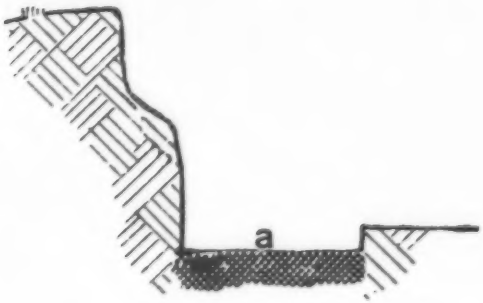


1.a) Apply 5 L/m^2 beneath footing prior to pouring concrete.

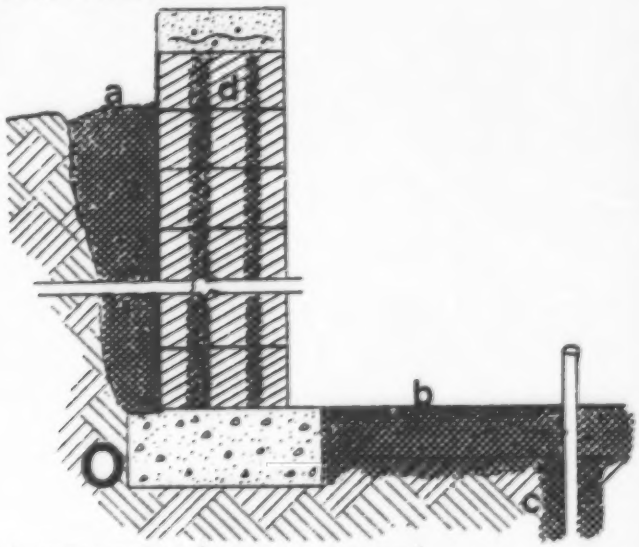


2.a) Apply 6L/linear metre/25 cm of depth to top of footing as soil is backfilled.
b) Apply 5 L/m^2 to soil before slab is poured.*

B. BASEMENT CONSTRUCTION - HOLLOW BLOCK FOUNDATION



1.a) Apply 5 L/m^2 beneath footing prior to pouring concrete.

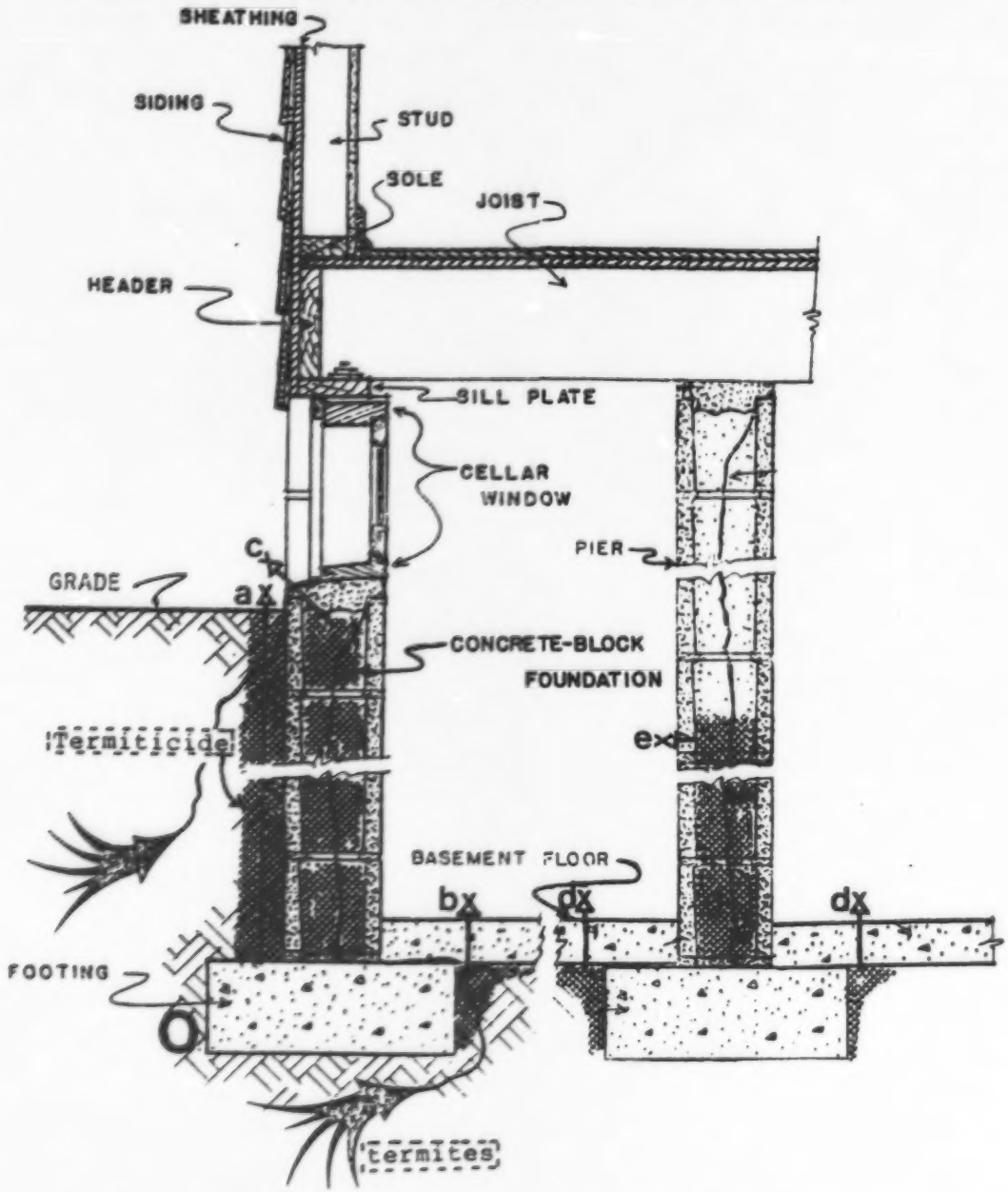


2.a) Apply 6 L/linear metre/ 25 cm of depth to top of footing as soil is backfilled.
b) Apply 5 L/m^2 to soil before slab is poured.
c) Apply 6 L/linear metre(25 cm depth) to critical areas e.g. utility pipes, stair stringers, etc.
d) Apply 1.5 L/0.5 m into block or brick voids prior to capping (optional if area beneath footing has been treated).

* Note: Remember to subtract the treated footing trench of the interior vertical perimeter barrier when calculating the area of treatment beneath.

APPENDIX VII
EXISTING STRUCTURE RATES OF APPLICATION

A. BASEMENT CONSTRUCTION - HOLLOW BLOCK FOUNDATION



1. a) Apply 5 L/linear metre/25 cm of depth from grade to top of footings at 25 - 30 cm intervals to soil at exterior foundation perimeter.
   b) Apply 7.5 L/linear metre to soil beneath slab at 30 - 40 cm intervals, 15 - 30 cm from inside foundation wall.
   c) If active infestation exists and wall will hold chemical apply 1.5L/0.5 linear metres into hollow block foundation. Apply from outside where practical.
   d) Apply 6 L/m2 into soil beneath slab of support pier.
   e) Apply 1.5 L/0.5 metres into the pier void.

APPENDIX VIII

EQUIPMENT FOR SUBTERRANEAN TERMITE CONTROL

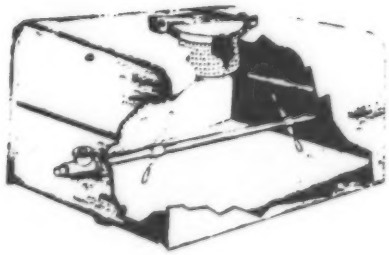
Termite control is heavy industrial-type work. Use heavy duty equipment to make the work as easy as possible and to avoid costly breakdowns. The basic piece of equipment for termite control forces chemicals into the soil encasing a structure.

Components of Power Spray Equipment

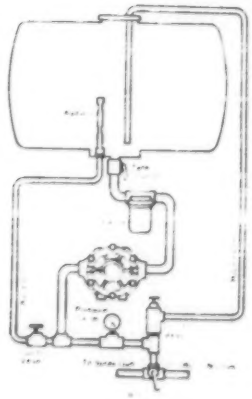
In general, equipment should have the pump capacity to provide enough in-line pressure for a 200-350 kPa pressure, chemical-resistant hose reaching halfway around the structures normally treated. Use either gasoline-powered engines or electric motors, but gasoline may be more portable if much outside work is done or if used for other types of outside work.

Tanks

The tank is a major component of a sprayer. It should be large enough to avoid the need for too frequent refilling which is time-consuming and inconvenient (a nozzle discharge of 45 rpm will empty a 450 litre tank in only 10 minutes. Too large a tank is wasteful if seldom filled). Stainless steel and fiberglass are corrosion resistant and can be rinsed easily and thoroughly. Every spray tank should have shut-off valves so that any liquid in the tank can be held there without leaking out of the pumps, strainers or other parts of the system which are serviced most frequently. A tank should be fitted with an opening large enough for convenient filling, inspection and cleaning. Drain plugs should be located for easy accessibility.



Tank with mechanical agitation



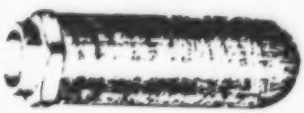
Sprayer system using hydraulic agitation

Agitators

The need for agitation depends on the type of chemicals applied. Emulsions require little agitation, but wettable-powder suspensions require vigorous agitation to prevent settling out. Tanks with square corners require better agitation than tanks with rounded shapes.

There are two methods of agitating the spray material in the tank. **Mechanical agitation**, the most positive method, is provided by paddles or propeller. **Hydraulic agitation** is provided by the return flow of excess spray material from the pump. When hydraulic agitation is used to suspend wettable powders, as might be the case when using a low-pressure sprayer, a simple by-pass line from the relieve valve is not enough. There should be a separate agitator line from the pressure side of the pump to the bottom of the tank.

Strainers



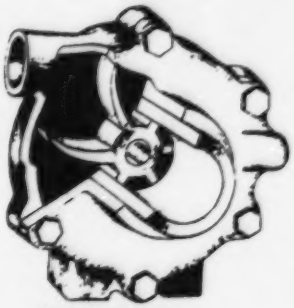
Strainer

Strainers, installed as necessary in the pressure line, the intake line or the nozzle, are used to prevent scale, rust flakes and other foreign material from plugging the nozzle or other working parts of the sprayer.

Pumps

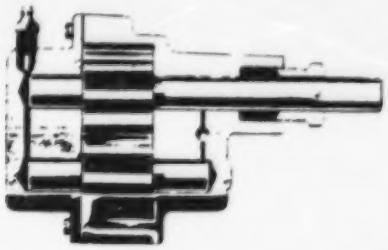
A spray pump must deliver the required pressure and volume within its normal working capacity so it is not constantly working at its limit. If abrasive materials are used, it must be able to pump them over a long period without much loss of performance. Metal parts must be resistant to corrosion if corrosive materials are to be used. Gaskets, plunger cups and impellers that are resistant to swelling or chemical breakdown are required. If wettable powders are used, the pump must be abrasion resistant.

Never operate a sprayer pump at speeds or pressures above those recommended by the manufacturer. The pump usually takes this stress for a short time but will soon break down or wear out. Never run pumps dry since they depend on the spray liquid for lubrication. Some spraying applications require only simple economical pumps. Generally speaking, as the pressure and volume requirements increase, the cost and complexity of a satisfactory pump also increase.



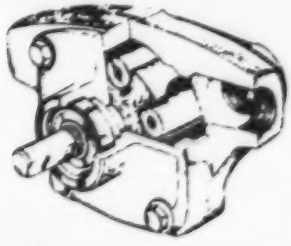
Centrifugal pump

Centrifugal pumps use an impeller to give high volumes at low pressures, although current two-stage centrifugal pumps develop pressures in excess of 1380 kPa. The power requirement is relatively low and the operating speed is relatively high. These are the only sprayer pumps in general use that are not positive displacement pumps, so pressure regulators or release valves are not essential. Pressure depends on rpm of the pumps. Because the impeller does not contact the pump housing, most centrifugal pumps are satisfactory for pumping abrasive mixtures such as wettable-powder suspensions even when they are concentrated. Centrifugal pumps are not self-priming, so mount them below the tank outlet or build a priming system.



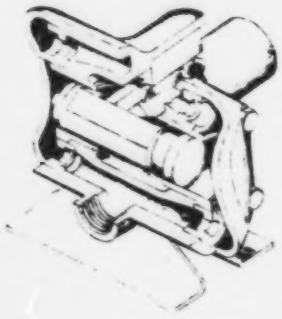
Gear pump

Gear pumps are simple, positive displacement pumps for use on agricultural sprayers with operator pressures up to 690 kPa. They are satisfactory for pumping liquids or emulsions but wear rapidly if suspensions are used. They are self-priming when in good conditions, but may lose that ability when worn. Depending on size, they deliver low-to-moderate volumes of liquid. They are not affected by solvents since all the parts are metal. Some are cast iron with stainless steel impellers; others are bronze to resist corrosion. The power requirement for gear pumps is greater than for centrifugal pumps but it is still relatively low. When a gear pump becomes worn, it usually cannot be rebuilt satisfactorily.



Roller pump

Roller pumps are commonly used on low-pressure sprayers. They are positive displacement, self-priming pumps with a slightly higher power requirement than gear pumps. Nylon or rubber rollers are more resistant to abrasion than gear pumps and can be replaced when worm or swollen. However, suspensions wear the rest of the pump out after a while. Roller pumps are capable of higher pressure than the gear pumps, but sustained operation at maximum pressures often causes seals to blow out.



Piston pump

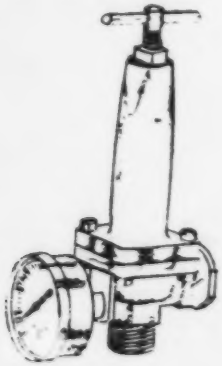
Piston pumps are heavily built and the larger ones are capable of pressures of 4100 kPa or more. They deliver moderate-to-high volumes depending on the pump capacity. Better quality pumps have replaceable plunger cups made of leather, neoprene or nylon fabric so they are resistant to abrasion, easily rebuilt and capable of handling wettable-powder suspensions year after year. The power requirement is higher than for other pumps. For low pressure sprayers, piston pumps are not usually needed, but they are excellent where higher pressures are required or where both low and high pressures are needed.

Surge tank

Use a surge tank in conjunction with a piston pump. A piston pump produces a pulsating flow which can damage gauges, valves, hose fittings, the pump and other parts. A surge tank reduces pulsation by absorbing the high pressure peaks caused by pulsation.

Pressure Regulators

A pressure regulator is one of the most important parts of a sprayer. It controls the pressure and therefore the quantity of spray material delivered by the nozzles. It protects pump seals, hoses and other sprayer parts from damage because of excessive pressure and by-passes the excess spray material back to the tank.



Pressure regulator

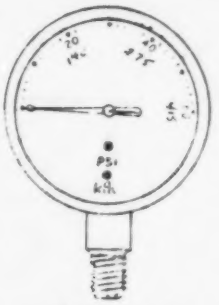
Relief valve

Pressure unloader

There are two types of pressure regulators -- **simple relief valves** and **pressure unloaders**. Relief valves are simple bypass valves that require the pump and engine to keep working just as though one were spraying, whereas, the unloaders maintain working pressure on the discharge end of the system but move the overflow back into the tank at lower pressure thus reducing strain on the engine and pump.

In the past, almost all high pressure hydraulic sprayers were equipped with unloaders, but now, probably as an economy move, the trend is toward relief valves. There is no substitute for a spring-loaded regulator. Be certain that the flow capacity of the regulator matches that of the pump being used.

Pressure Gauge

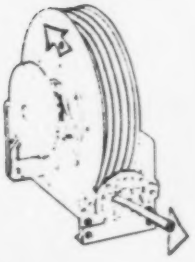

Pressure gauge

A pressure gauge is essential on any sprayer for the operator to tell how the sprayer is functioning. If the pressure does not remain constant, the amount of liquid coming out of the nozzle varies. Always mount the gauge so the operator can see it easily.

Hoses

There are four main points to consider in selecting sprayer hoses:

1. Composition (particular the liner material).
2. Construction (reinforcement, rigidity or flexibility).
3. Working pressure.
4. Size.



Hose

The hose liner should be resistant to chemical action of the spray materials. The working pressure of the hoses should be equal to the maximum pressure the pump delivers. If the hose is too small (inside diameter), the sprayer will not operate properly. If the hose in the suction line is too small, the pump will starve. If the hose in the pressure line is too small, there will be excessive pressure and a drop in volume.

Treating Tools

Sub-slab injector

Soil rodding device

Various types of implements are used on the end of the hose, but a good, quick-acting valve is highly desirable between the hose and the implement. Generally, three different types of treating tools are used:

1. Ninety centimetre to 2 metre pipes used to force chemicals down into the soil along foundations frequently referred to as rods or soil rodding devices. Some are available in sections to suit different needs. Various tips are available for use on these rods.

2. Various shorter pipes or rods to inject chemicals into void areas.

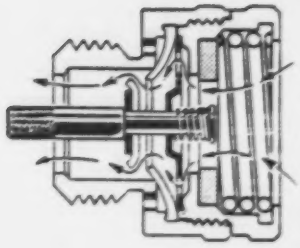
3. A sub-slab injector for inserting chemicals through a hole in a concrete slab and into the soil beneath the slab. These injectors seal the hole around the injector tube preventing the chemical from spewing out of the hole as a result of the back pressure developed.

Calibration

Application rates can be determined by using a flow meter (the most recommended method) or the "slow-count" metod. The second method is only an estimate in which a 4.5 litre container is filled and timed with a watch or by counting slowly. Soil composition and compaction also affect delivery rate, thus a flow meter is preferable.

Back-Flow Preventers

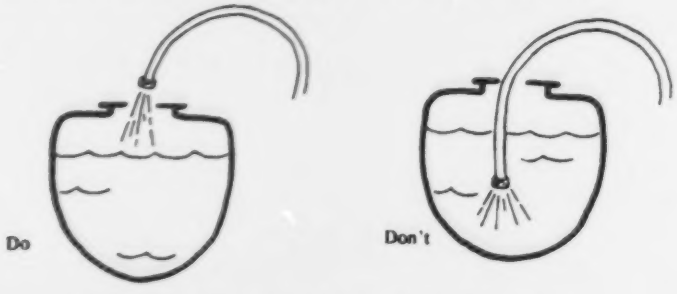
Take precautions to insure that the water supply system does not become contaminated with termite control chemicals. If the discharge end of the filler hose is below the surface of the liquid in the tank and a sudden drop in pressure occurs in the water system, pesticides an be siphoned from the tank, contaminating the water supply Back-siphoning can be prevented easily with little expense involved.



Back-flow preventer

Use a back-flow prevention device on he filler hose or install an anti-siphon device on the tank. The back-flow prevention device is attached to the end of the hose before it is connected to the hose bib. The anti-siphon device provides a physical separation of several inches between the discharge end of the base and the surface of the liquid in the tank.

If none of these devices are available, hold the filler hose well above the tank throughout the filling operation so that water running out of the hose can be observed.



Prevent back-siphonage: hold the filler hose well above the tank

Operating Precautions for Pesticide Equipment

1. Never use a pin, knife or other metal object to unplug a nozzle. Use compressed air or a brush with soft bristles. Never blow into a nozzle to clean it.

2. Never allow dirty water or debris to enter the tank.

3. Never operate a sprayer with any of the screens or filters removed. If the screen constantly becomes plugged, replace it with a screen of the proper mesh and capacity.

4. Never allow any sprayer pump to run without water even for a short time; pump seals, bearings and other working parts may be severely damaged.

5. Always pump a large amount of clean water through the sprayer when changing from one pesticide to another. Clean all nozzle tips and screens at the same time.

Storing the Sprayer

Proper storage of your sprayer can add years to its useful life.

1. Clean the sprayer thoroughly.

2. Completely lubricate all moving parts according the manufacturer's recommendations.

3. Make a list of all faulty parts and order new ones in time for the following season.

4. Fill the tank with water and add the recommended quantity and type of rust inhibitor or new light oil (see your instruction manual). Drain the tank. Leave all tank openings uncovered for ventilation but screen them to keep out dust, debris, insects and animals.

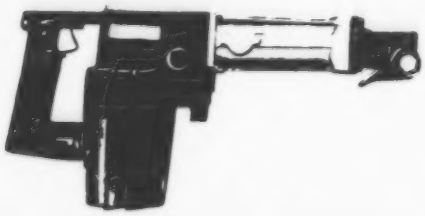
5. Clean all nozzle tips and screens with compressed air or a soft brush and kerosene. Store the tips and screens in a jar of new light oil or kerosene.

6. Take the weight off of any tires.

7. Remove, clean and drain the pump. Fill it with the light oil, anti-freeze or rust inhibitor recommended by the pump manufacturer. Seal all pump openings to keep out dust, dirt, insects and animals.

Other Equipment

Durable Drill



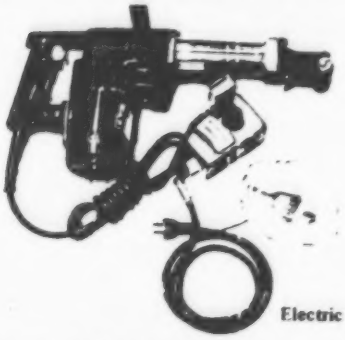
Termite work requires drilling holes in concrete floors, walks, porches, patios, driveways and walls. A rugged drill is required. One of the most common drills used is the electric rotary hammer drill which is available in various sizes. Carbide-tipped bits, though more expensive than steel, cut faster and require much less sharpening. Use of "A-taper" or "B-taper" bits and an adapter allow complete interchangeability of bits.

It is frequently necessary to drill holes through masonry and into void areas of foundation walls. Use either an electric hand drill or a 3/8 inch high-speed hammer drill with carbide-tipped rotary bits.

Grounding Equipment or Devices

Electric power tools are particularly hazardous to the termite control worker. It is necessary to have plugs that ground all electric equipment. Make sure circuits are grounded. There are simple devices available which indicate properly grounded circuits.

Ground fault interrupters are an effective method of preventing shock. Properly used, they are designed to break the circuit and shut off the current in a fraction of a second if there is even a tiny short in the circuit.



Electric drill stopper or cut-off unit

Ground fault interrupter

Use **electric drill stopper or cut-off units** with electric drills or hammers. If properly used, they are designed to shut off the current to the tool whenever the drill strikes a grounded object such as a radiant heating pipe, water or gas pipe or electrical conduit. To do this, they must be connected to a properly grounded circuit.

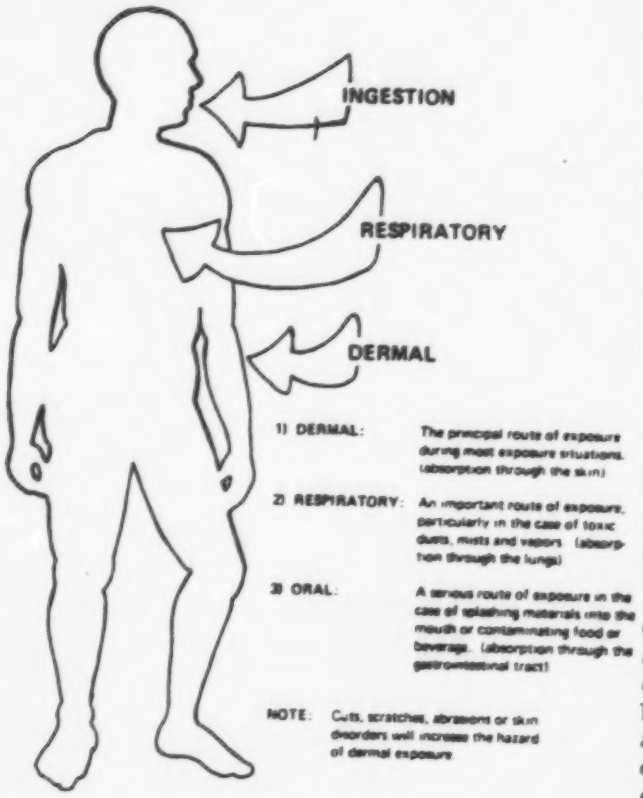
Wear unlined rubber gloves with long cuffs designed for electrical workers. Do not use electrical equipment in areas where water has been allowed to cover standing surfaces. Before each wearing, visually inspect gloves for physical defects and deterioration by trapping air inside each glove. Discard gloves showing any sign of wear, cuts or punctures.

Workers handling tools or rough objects should wear specially designed, leather glove protectors to prevent punctures and abrasions to the rubber gloves. Cuffs of these gloves should be shorter than for rubber gloves and preferably made of rubber or other insulating material.

Workers should also wear rubber or leather boots specifically designed to prevent electrical shock. These boots eliminate metal contact and provide insualtion. Soles and heels of these leather boots are stitched or pegged with a non-metal material. Some types have a double leather sole with a rubber sheeting in between to increase electrical resistance.

APPENDIX IX
SAFE USE OF TERMITICIDES

Proper handling, use, storage and disposal; recognition of local environmental situations requiring special care; and an awareness of poisoning symptoms and procedures to follow in the case of pesticide poisonings are each essential elements of safe use.


INGESTION
RESPIRATORY
DERMAL
1) DERMAL: The principal route of exposure during most exposure situations. (absorption through the skin)
2) RESPIRATORY: An important route of exposure, particularly in the case of toxic dusts, mists and vapors. (absorption through the lungs)
3) ORAL: A serious route of exposure in the case of splashing materials into the mouth or contaminating food or beverage. (absorption through the gastrointestinal tract)
NOTE: Cuts, scratches, abrasions or skin disorders will increase the hazard of dermal exposure

The importance of the product label as an information source cannot be overemphasized. Precautionary statements; hazards to man, domestic animals and the environment; and storage and disposal information, all a part of the label, are guides to safe use. Safe use begins with purchase, continues through proper use and is complete only with proper disposal of waste and the used container. Remember, few safety recommendations cover all situations. However, some general guidelines, if followed along with information on the product label, should result in a safe use experience.

Chemicals used as termiticides are poisonous, and one must exercise care in their handling and use to avoid accidental poisoning; damage or irritation of the skin or eyes; and damage to property and the environment.

Termiticides may enter the body through the skin, lungs or mouth. Entry through the skin is often the more likely route of exposure during handling, mixing and use of a termiticide. Protection from unsafe exposure to termiticide requires constant attention and planning.

Avoid spilling chemicals on skin when handling and applying the termiticide. Avoid breathing vapours and spray mist. Wear a hard hat, protective clothing, rubber gloves, goggles or face mask and steel-tipped shoes with rubber soles or rubber boots whenever exposure hazards are present.

Skin exposure is minimized by using protective clothing. As a general ruse use clean clothing daily. A long-sleeved shirt and full-length trousers or a coverall-type garment made of closely woven material are minimum requirements. Cover up before exposure -- not afterwards. Covering contaminated skin increases absorption of some chemicals.

When working in a poorly ventilated area or a crawl space use an approved respirator. Maintain maximum ventilation through use of properly positioned fans when working in places where air movement is limited.

Various types of respirators can provide protection. Most respirators purify air by removing contaminants through filtering or chemical action. Filters remove particles by physically (mechanically) trapping as air is inhaled. Mechanical filters do not provide protection against gases, vapours or oxygen deficiency.

Cartridge respirator

Some respirators have cartridges or canisters which contain a chemical that removes gases or vapours. Read the product label. If a respirator is required, the information will appear on the label. And remember, no matter how well a respiratory device is designed and made, unless properly maintained and used, it may fail to provide protection.

If clothes become wet with spray or if chemical, solution or emulsion is spilled or splashed on clothing or skin, remove clothing and wash immediately with soap and water. Decontamination of skin is generally more efficient if done promptly. Destroy heavily contaminated clothing. Do not store or wash contaminated clothing with the family laundry.

If chemical, solution or emulsion is splashed into the eye, immediately wash it with a gentle stream of water for 15 minutes and all a physician.

Termiticides may also enter the body through the mouth. Accidental splashing or transfer of termiticide to the mouth through wiping one's face on the sleeve, cuff or hand are likely ways for entry into the mouth. Other possibilities include food handled with contaminated hands or food exposed to spray or spray mist, spills and contaminated drinking utensils.

Check the label for special instructions or warnings regarding exposure. Never eat, drink or smoke while applying termiticides. Do not wipe the mouth with hands, forearm or clothing. Do not expose lunch, lunch containers and beverage or drinking vessel to termiticides. Wash thoroughly with soap and water before eating or drinking.

Remove children and pets from the work area and all soil areas treated for termite control. Advise the customer to consult a physician before treatment commences if anyone in the family has a known health problem.

Water supply is especially critica.. Contaminating a well or cistern can be disastrous, not only to the family who uses the water for drinking, cooking and bathing but also to an entire community. Before treating, pinpoint the location and depth of the water supply of the dwelling and those adjacent to it. Then look for patterns of rain runoff and plan the treatment accordingly. Treat cautiously at the point of water connection. Do not treat the soil beneath a house that has a well or cistern within the foundation walls.

If the customer's water supply is used in mixing, the chemical may back up into the plumbing, contaminating the water. Guard against back siphoning by attaching a backflow preventor to the water connection. Do not allow the end of the filler hose to extend or drop into the mixing tank.

Be sure equipment is working properly and calibrate the pump at regular intervals to assure that the correct amount of chemical emulsion is being delivered. To calibrate the pump, fill a 4.5 litre container and count off or time how long it takes. This indicates how long it takes to pump 4.5 litres of chemical. Better yet, use a flow meter. Make sure hoses, fittings and connections are in good repair and do not leak.

Electrical tools can also be hazardous, both to the user and the building as well. Check electrical tools frequently and make sure electrical cords are in good condition. Examine drills, drop lights, extension cords -- every tool that could cause an electrical problem. Use all electrical tools carefully. Ground them with a ground fault interrupter or, for greater safety, by attaching a grounding wire to a cold water pipe.

Avoid overloading electrical circuits. Before plugging in tools, look for outlets where heavy-duty wiring is normally used, for example, in the kitchen, basement or utility room. Never use electrical tools around water. When outside, do not work during a rain or near wet vegetation or excessively wet earth. When indoors, avoid puddles on basement floors.

Be prepared to cope with an emergency. Carry a change of clean clothes, hand soap, towelling, a container of heavy duty household detergent and, in case of an accidental spill, cat litter, industrial absorbent pads or other spill control material and a small shovel. Also include a supply of heavy duty plastic bags to transport contaminated absorbent and towelling for proper disposal.

Termiticide manufacturers may provide specific information for handling spills and other product-related emergencies. Obtain and be familiar with this information. In the event of a spill or other emergency endangering life or property the product manufacturer may provide additional assistance. For this reason maintain the manufacturer's emergency telephone number readily at hand.

Canutec (613-996-6666) provides immediate advice to callers anywhere on how to cope with chemical emergencies. Canutec is the Canadian Transport Emergency Centre. The Centre, a public service, is located in Ottawa and is operated by the Transport of Dangerous Goods Branch of Transport Canada. Spills should also be reported to the Ministry of the Environment Spills Action Centre (SAC) 1-800-268-6060 when an emergency situation exists.

The information provides regarding safety is not intended to replace or supercede the information on product labels, applicable regulations regarding the handling of toxic material or applicable regulations for the performance of structural pest control tasks. Always read and follow the instructional warning statements and other information provided on the product label and consult currently applicable federal, provincial and municipal laws and regulations. Safety is no accident. The time spent planning for and implementing safe use practices will minimize the risk of accident involving termiticides.

**PESTICIDES ARE POISONS –
TREAT THEM AS SUCH**